THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXXII. No. 792.] LONDON, JULY 16, 1878. [30th Year.] Price 6d.

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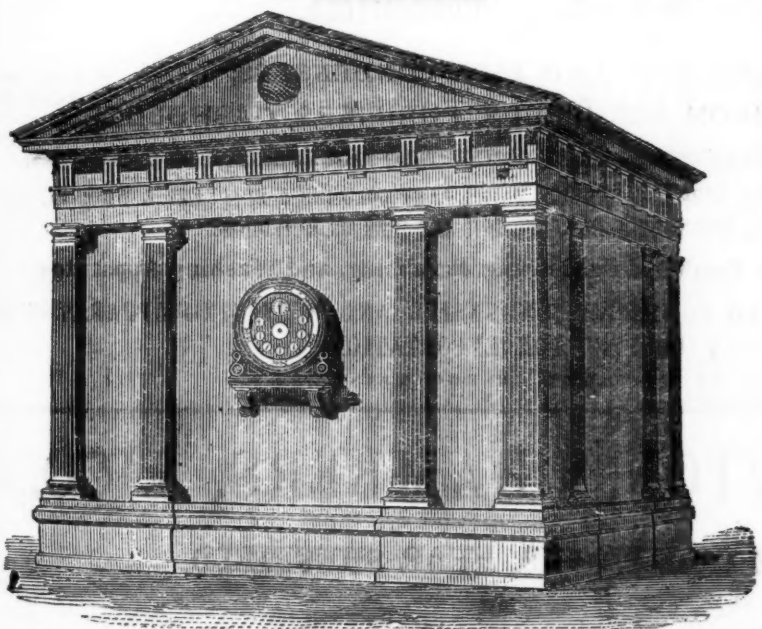

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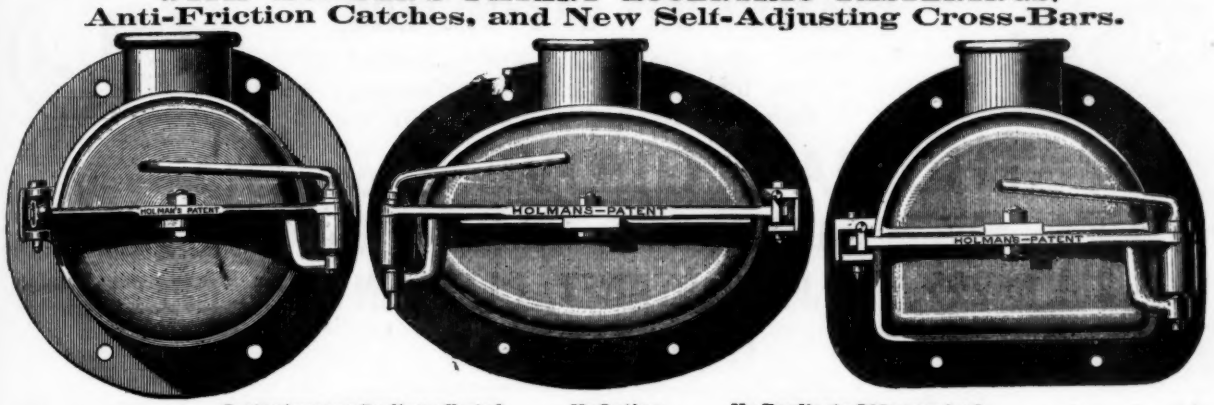

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Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

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In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

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TESTIMONIAL.

The Gaslight and Coke Company,
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Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
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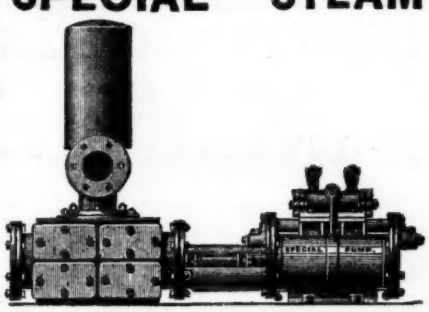
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



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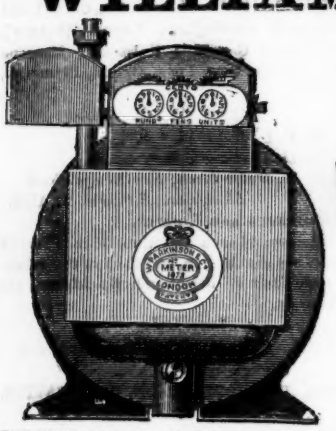

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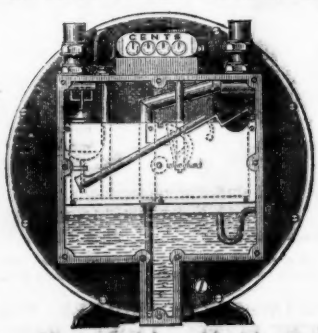

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

J. W., Berwick.—*Your remedy, under the circumstances named, would be to fix a governor before the meter.*

R. G., Carrickfergus.—*Boil the liquor down in a leaden pan, and rake out the crystals as they form.*

J. T., Inverness.—*We have never heard of the use of ammoniacal liquor for mixing iron cement, and doubt its efficiency.*

TO SUBSCRIBERS.

Subscribers who desire to avail themselves of the reduction in the subscription to the JOURNAL by paying in advance for the second half of the year 1878, are reminded that this can only be done during the present month.

Subscribers who have not paid their subscriptions for this, or for any previous year, are requested to remit the same forthwith to the Publisher, in order to prevent any interruption in the regular delivery of the JOURNAL.

Cloth cases for binding the JOURNAL may be obtained on order from any Bookseller, or from the office; but the Publisher cannot receive the numbers to bind for Subscribers.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 16, 1878.

Circular to Gas Companies.

THE report of the Meeting of the Société Technique de l'Industrie du Gaz en France, published in another column, gives a very interesting account of the progress made by that Society. It rapidly increases in numbers, and the communications presented show that the Members are anxious to make the Society of value. The list of papers contains the mention of some subjects which we expect were of much interest, and we shall have great pleasure in offering to our readers a translation of them as they appear in the Journal of the Society. We may assume that the Association is financially successful, for we notice that its funds are contributed to by many of the French Gas Companies. We wish it could be found possible for English Companies to add to the resources of the British Association of Gas Managers, but we fear that Auditors would often raise objections. It is in the power of many Companies, however, to devote money to such a purpose, and we may express a strong opinion that it could not be spent in a way more calculated to advance their best interests. Every improvement made in the construction of apparatus or in manufacturing details is a gain to Companies in a pecuniary sense, and a subsidy to the Association would be really an investment. Its usefulness would be largely promoted by increased funds. We are no great admirers of the prize system, which does not seem to answer particularly well in France, where prizes are given for everything. Still, the prospect of a reward and some distinction does stimulate the energies of many men, and we should be glad if our Association had the means of offering more encouragement to inventive genius. We commend the claims of our Association to the notice of Gas Companies and Corporations who may have the power to apply money for the furtherance of scientific progress.

A few words will dispose of the festivities and compliments attending the meeting. The *entente cordiale* was thoroughly maintained. The Société Technique reciprocated the compliment of the British Association, by electing the Present and Past Presidents as Honorary Members.

The instructive paper read by Mr. Hunt, of Birmingham, at the recent Meeting of the British Association of Gas Managers, again draws attention to a matter which cannot receive too much attention at the hands of Gas Managers. So far as the manufacturing operations are concerned, some loss is inevitable; but Mr. Hunt points out in what way much of this may be obviated. We notice that in calculating the deficiency of gaseous products, Mr. Hunt includes carbonic acid and sulphuretted hydrogen in his best example, which, together, give a total of 37·68 lbs. per ton of coal, the whole loss on a ton of coal distilled being set down at 50·06 lbs.; so that it appears more than half the deficiency consists of useless and obnoxious products, which is some consolation to a Manager. The other sources of preventible waste in the retort-house and distributing plant are perhaps more easily dealt with; but even here, under the best of circumstances, some loss is unavoidable. Waste, which is caused by bad fittings and burners, is perhaps the most serious of all, but as it only concerns the Consumer, Managers rarely trouble themselves about the matter. A Gas Company may, however, do much in the way of instructing their customers in the selection of the best apparatus, and, to this end, exhibitions, such as that recently held at Birmingham, are eminently useful. As people find gas cheap and brilliant, they use much more of it; hence it is the direct interest of those who supply gas to teach their customers how best to consume it. The burner question is not yet settled, and it may be we shall have further developments in the construction of these instruments. Mr. Hunt well deserved the thanks of the meeting for his valuable paper.

That an improved standard for determining the illuminating power of gas is a great desideratum is not to be denied, and every effort to find a substitute for candles must be approved. The much-abused candle, however, still holds its own, and will, we think, do so for many years to come. The radiometer, from which so much was once expected, has been definitively renounced as a test for the intensity of the light afforded by a flame. Mr. Vernon Harcourt's pentane gas test is a practical one, but it is really candles in disguise, and we do not see any possibility of introducing it as a parliamentary standard. Lowe's jet photometer and Sugg's illuminating power meter are useful and simple means of obtaining indications of illuminating power; but here again we have candles in disguise. So many inches of flame are taken to represent so many candles power. That candles vary, everybody knows; but, as it is often said, the variations in well-made candles, used with care and skill, are not great. The position of the wick is of some importance, but of still more consequence is the proper centring of the flames. Mr. Methven's reproduction of Mr. Fiddes's ingenious idea is not, we think, likely to be received with much favour; but it was well to have the general question of the means of estimating illuminating power brought under consideration. Mr. Methven's paper was a peg on which a very useful discussion was hung, and, therefore, did not constitute the least interesting feature of the meeting.

The Corporation of Exeter are evidently intent on giving the month's notice of their desire to purchase the undertaking of the Exeter Gas Company as soon as the time arrives for its being delivered. There are complaints on the part of some in the Council that the price agreed to be paid, in the event of purchase, is much too high, but it is really the lowest that could possibly be fixed. If arbitration had been resorted to, it is probable that the Shareholders would have been awarded something more than they will receive under the agreement. The prospects of the Corporation with regard to the gas undertaking are exceedingly

good; but it must be confessed that, with the gas and water undertakings somewhat suddenly thrown on their hands, the energies of the ablest men in the Council will be severely taxed.

The prospectus is issued of the West of England Compressed Peat Company, Limited, which is formed to utilize the vast deposits of peat on Dartmoor. The seat of the Company, we notice, is at Exeter, and it may be that its formation offers a grand opportunity to the Corporation of that city. Peat, when distilled, yields a large quantity of gas of high illuminating power, perfectly free from obnoxious sulphur impurities, and leaves a valuable residual in the shape of charcoal, much esteemed as a filtering medium, and useful as fuel. We have recently had before us the record of a large number of experiments, made in Russia, on the distillation of peat for gas, and we are bound to say that they fully bear out the statements made in this prospectus, which ought, however, to have been supported by the independent testimony of some English gas-maker. Peat, we are told, when properly carbonized, will yield about eleven thousand cubic feet of gas, of twenty-two and a half candle power, and a quantity of tar, which, when distilled, will, besides the light oils, furnish a considerable amount of soft paraffin. Everything will, of course, depend on the cost at which the material, in a fit state for carbonization, could be produced. It might, perhaps, compete with a low-class cannel of equal gas-producing power, for the cost of purification would be less, and the value of residuals, perhaps, greater. We can, however, express no decided opinion, and must wait to see what practical results are obtained when this Company commence operations, and find a market for their material in the gas world.

The Leicester Town Council are much in the same position as their *confrères* at Exeter. They have gas and water works suddenly thrown upon their hands, and it has been found necessary to appoint a Committee to carry on the former. We rather pity the case of gentlemen, unaccustomed to business of the kind, who have thrust upon them the management of a very important undertaking. New Directors of Gas Companies always find colleagues in office who are well acquainted with the business, and so it will be in time with Committees of Corporations. At first, they start as novices, but serious attention soon makes them acquainted with gas management. For the moment, they have mainly to rely on the advice of their Manager. At Leicester the Corporation have the good fortune to have on the Committee an old and very capable Director of the Company, so we expect that all will go well.

We have received the report and balance-sheet of the Saltcoats Gaslight Company, which goes further into details than such documents usually do. We are, for example, told the source of the coal used, and the price paid for it; and also the exact cost of gas per thousand feet. We are further told the quantity of gas yielded by each particular kind of coal. A document of this kind issued by a Gas Company is, so far as we know, unique; but there can be no reason why Shareholders should not be made acquainted with all the details of the affairs of their Company.

The Town Council of Southampton designed to make use of a steam-roller, and the Gas Company very properly remonstrated, and fortified their position by a report from their Consulting Engineer (Mr. J. B. Paddon), who has had an opportunity of witnessing the effects of heavy rollers on gas-mains. If these weighty machines are to be brought into general use, gas-mains must be laid at a lower depth than that at which they are now deposited. The rollers are a blessing to horses and the riders in carriages, but are most certainly detrimental to the stability of gas and water mains, and Gas and Water Companies must carefully watch their effects.

The Corporation of Rochdale went in for hydraulic stokers at their gas-works; but, like the Vicar of Wakefield's picture, which could not be got into his house when painted, the scoops of the Rochdale hydraulic stokers have been found too large to get into the present retorts. These are, however, being worn out, and will presently be replaced by new and clean ones, when the hydraulic stokers, which have been lying idle for three years, may be brought into operation. If, as some allege, the machines are degenerating into old iron, the fault lies upon somebody's back. It takes very little trouble and expense to keep machinery not in action clean and ready for immediate use.

It is still a question with the Brighton Board of Guardians whether or not they should get gas supplied to the Industrial Schools from the Gas Company, or whether they should manufacture gas for themselves. That gas should replace the present dangerous mode of illumination is admitted on all hands; but the question arises how it can be most cheaply obtained. We believe that, notwithstanding the length of pipe required to carry gas from the Company's main, and the cost of it, the Guardians would find it most economical to buy the gas, and not to make it. They will, no doubt, have offers made to them by inventors who profess to make gas from anything—from cabbage stumps and kitchen grease, for example; but they will, in the long run, find their advantage in having a supply of good gas from a responsible Company.

The Meeting last week of the North British Association of Gas Managers, held at St. Andrew's, under the presidency of Mr. J. Hall, was of a highly interesting character. The papers read were, as we mentioned last week, but few in number for the extended time which the Association gave on this occasion; but the attention of the Members was fully occupied by an useful Exhibition of Gas Apparatus of various kinds, in operation. The excursions included a visit to the Corporation Gas-Works at Dundee, where the Members of the Association were very cordially received by Mr. M'Crae and Mr. Mitchell, and also a trip to the Tay Bridge, the latest engineering wonder of the age. We shall give in future numbers of the JOURNAL full reports of the papers read and of the discussions that ensued. We may add that the next Annual Meeting of the Association will be held in Edinburgh, the President Elect being Mr. Alexander Smith, of the Corporation Gas-Works, Aberdeen.

Water and Sanitary Notes.

THE opponents of the Metropolitan Water Companies are very anxious that the Government should take some steps to carry out their wishes, and some chance words uttered by the Home Secretary at the beginning of the session seem to have led Sir U. Kay-Shuttleworth to imagine that the Government were pledged to take action of some kind or other in the matter. The worthy baronet was put right by Mr. Cross, who explained that the Government were pledged to nothing as regards the gas and water supply of the Metropolis. The fact of the Southwark and Vauxhall Company having failed to give a full supply of water to Peckham and Bermondsey is much to be regretted. The reservoir at Nunhead was designed and made to afford an efficient supply to these districts; but, unfortunately, the state of the works has prevented it being brought into use. So soon as the necessary repairs have been completed, Peckham and Bermondsey will be adequately supplied. The complaints of an insufficient supply of water at a fire in the former locality appear to be unfounded; such, at all events, is the turncock's statement, who says that he was not called when the fire was first discovered. Without representing that the water supply south of the Thames is as efficient as might be desired, we must protest against the exaggerated statements which are intended to injure, in public reputation, the Southwark and Vauxhall Company.

Dr. Frankland reports that during June the Thames and Lea were much swollen by heavy rains, and the water delivered by seven of the eight London Water Companies was so much polluted by organic matter as to be unfit for dietetic purposes. It is quite time that statements of this kind had ceased to be published with any official sanction. While the water was said to be unfit for dietetic purposes, no inhabitant of the Metropolis discovered that there was anything amiss with it; and what is more, London was exceptionally healthy. No good is done by the publication of these reports. They frighten old women of both sexes, but the scare comes too late. The water which was represented as turbid and loaded with organic matter yesterday, but still did no harm, is pellucid and pure to-day, and no one is either better or worse. That water from the chalk wells should be bright while the river supply is turbid, surprises no one. The efforts of certain parties, however, to effect a change in the water supply of the Metropolis will be ineffectual for years to come. The time may arrive when additional sources must be tapped, but it will only be when the river supply requires to be supplemented. We shall not regret to see a more extended use of chalk waters, but it can only be in addition to, and not in substitution of, the river supplies, which now so efficiently serve the Metropolitan public.

The Corporation of Halifax have just completed some extensive new water-works, which will add largely to the supply of the borough and neighbourhood. The new reservoir is 2223 acres in extent, and has a capacity of 645,000,000 gallons. The cost of it, and of the necessary connecting works, will exceed £627,000—a sum which the Corporation have already borrowed. These costly works will constitute a heavy burden upon the ratepayers, but they are absolutely essential for the well-being of the inhabitants. Halifax has now a copious supply of water, and is not likely to suffer from drought.

The Rivers Pollution Act is being gradually brought into action in many parts of the country, and we may hope that its

operation will be beneficial. But we once more express a strong opinion that manufacturers must not be sacrificed for the sake of coarse fish. Fresh-water fish can hardly be said to constitute a food for the people. As soon as a river is purified and stocked with fish, it will be strictly preserved to afford such sport as it can for the riparian proprietors and their friends. Such fish as can be caught, with the exception of salmon and trout, are hardly worth cooking, and are altogether rejected by the poor; rich people even find it difficult to make them palatable by the addition of sauces and condiments. This, however, is no argument against the prevention of the pollution of rivers, and all we wish to insist upon is that manufacturers must not be hindered in their operations by the designs of scheming people, who pretend to desire to increase the food of the nation.

After a delay of some months, Sir J. M. Hogg has succeeded in introducing the Bill promoted by the Metropolitan Board of Works to amend the Metropolis Management Act, 1855, so as to enable them to contruct works to prevent overflows of the Thames. The Bill has, of course, no chance of success this session, nor will it, we think, unless the provisions are so altered as to make the cost of the works a charge upon the whole of the Metropolis, in any succeeding session. We shall presently have the Bill before us, and then we shall be better able to judge of its merits.

The Stockton and Middlesbrough Corporations are not yet at the end of their troubles in relation to the transfer of the Water Company. It seems that the £800,000 already paid may not be sufficient to meet the claims of the Shareholders. In case it should be, the Company magnanimously offer to return any excess, but at the same time state, should there be any deficiency, the Corporation must make it up. In the meantime, another somewhat heavy item of account turns up—the stamp duty on the transfer amounts to no less a sum than £3400. It does seem hard that Government should exact from public bodies a sum like this, when the business, however mistaken, has been promoted for the public good; but the Revenue must be kept up, and Corporations must pay like the rest of us.

A considerable section of the inhabitants of Wimbledon are dissatisfied with their present water supply, and regard it as bad in quality and insufficient in quantity. As regards the quantity supplied we know nothing, but it is Thames water fairly well filtered, and the exceptionally healthy state of Wimbledon leads us to believe that no harm results from the use of the water. But the Local Board have called in Mr. Homersham, who proposes to sink wells in the chalk at Little Woodcote, twelve miles distant. It is difficult to judge of the feeling of ratepayers by a show of hands at a public meeting, but the scheme would seem to be generally approved. There are, however, difficulties to be overcome. A settlement must be made with the Water Company in possession, and then comes the question of the cost of the works to bring the water twelve miles. Probably the Local Board at Wimbledon will, if they persevere, find themselves landed in a debt of £70,000 or £80,000; but Wimbledon is a fast-growing place, and the debt might be no burden. But there is not the smallest necessity to incur it at all, and the thing most likely to stop the growth of Wimbledon would be increased rates.

Mr. Henry Phillips, of Exeter, sends us an ingenious diagram, showing the consequences of rainfall on ground irrigated with sewage. The advocates of sewage irrigation in general overlook the rainfall altogether, and seem to proceed on the assumption that sewage is the only liquid that reaches the land. The consequences are sometimes of much importance, for land often gets over-saturated and water-logged, to the great detriment of the produce. Mr. Phillips deserves thanks for calling attention to the matter, and to the necessity of providing means for carrying off rainfall.

Death of Mr. R. J. Millar.—We have to record the death of Mr. Robert James Millar, late Secretary of the City of London Gaslight and Coke Company. Mr. Millar was for many years in the service of the Company, and filled the office of Accountant until the retirement of Mr. Daniel Benham, about 25 years ago, when he was appointed Secretary in the place of that gentleman. He enjoyed the entire confidence of his Directors and the esteem of all his brother Officers. When the amalgamation of the City Company with the Chartered took place, Mr. Millar retired on a pension equal to his full salary, and has since resided with his only daughter, Mrs. Grace, at Wakefield. From a personal knowledge of Mr. Millar during a period of more than 38 years, we add our tribute of respect to his memory. He died on the 6th inst., in the 80th year of his age.

Portraits of Gas Managers.—Advantage was taken of the recent visit of the British Association of Gas Managers to the Phœnix Gasholder station in Kennington Oval, to secure portraits of the members and friends present. Mr. C. Latham, of 14, Denmark Road, Camberwell, succeeded in obtaining three photographic groups, each containing between 200 and 300 likenesses. Two of them, which have been submitted to us for inspection, are simply admirable; we do not remember to have seen anything so clear and well printed before. Many members, no doubt, will be glad to possess so pleasing a memorial of a very enjoyable day in connection with the Association.

WATER GAS.

(*Continued from Vol.* XXXI., *p.* 980.)

In the Journal of the 18th ult., we mentioned that Mr. Rowland had erected works for the Municipal Gaslight Company, New York, equal to the supply of 3 million cubic feet per day of carburetted water gas of 24-candle power. Of course, the bearer of the luminous matter in this case, as with all the others before mentioned, is composed of hydrogen and carbonic oxide; the result of the decomposition of water vapour by contact with incandescent carbon—in this instance, anthracite—which, by a process of carburetting, is made to receive and hold in combination hydrocarbon vapour enough to produce the prescribed illuminating power. So far there is nothing new. The novelties consist in the improvements introduced into those works for effecting the decomposition of the water, and so carburetting the resulting gas as to admit of it being supplied to consumers, throughout a large area, in a similar manner to coal gas, and with the same constant result as regards illuminating power.

It is our intention to illustrate and describe the most important portions of the apparatus connected with these works, but before doing so we shall notice the incidental origin of this apparently revolutionary Gas Company. In January of the year 1866, Mr. R. A. Brooman obtained a patent for an "Improved Method of Producing Oxygen. A communication from abroad by Charles Raphael Maréchal and Cyprien Marie Tessié du Motay, both of Metz, France," the specification of which patent, filed in the following July, states that the invention consists in deoxidizing manganates and permanganates of potassa, soda, and baryta, &c. By placing any one of these in a retort or other distillatory vessel, and passing thereinto a current of steam, oxygen will be liberated; this and the steam will pass from the retort to a condenser together, where the latter will be condensed, and the oxygen being left alone is to be passed into a holder for use. When all the oxygen has been evolved, the residue in the retort is treated with atmospheric air for the purpose of reoxidation, and *vice versâ*. The production of oxygen is continued in this alternate manner as long as may be required.

We shall see directly what this oxygen patent, with a revival of Kirkham's old water gas scheme, has incidentally accomplished in connection with the subject under consideration. Tessié du Motay having taken out patents for the United States, a Russian gentleman, M. Stern, then residing in the city of New York, purchased the sole right to use them there. This gentleman organized a Company in the city of Buffalo, state of New York, by whom works were erected for the manufacture of oxygen, and what was then known as Tessié du Motay's carburetted water gas. This Company laid, in some of the principal streets of the city, two sets of mains, one for oxygen and the other for the compound from water, in order to be in a position to produce the oxy-hydrogen jet for developing the calcium or lime light where *great lights* were required. This proved to be a failure in a commercial sense, and partially so in the practical application of the oxygen adjunct. We say *partially*, because the Company did actually light some of the principal streets of the city with the oxy-hydro flame in a very creditable manner, and for some considerable period of time; but imperfection of detail, together with the complexity and delicacy of the "gas-conveying harness," burners, &c., soon put an end to their functions, and the oxygen part of the undertaking was entirely abandoned. The Company were now alone with their water gas, which, notwithstanding the so-called improvements in apparatus, was so difficult to produce, mainly owing to the indifferent design and character of the plant, that, becoming discouraged with *new inventions*, they decided to abandon the apparatus, and supply their works with the ordinary coal gas-producing plant. The experience gained had, however, inspired M. Stern with renewed confidence in the ultimate success of carburetted water gas in localities where hydrocarbons were obtainable. He, therefore, resolved to devote his energies to the successful development of the scheme, notwithstanding the "wet blanket" it had received at Buffalo. At this crisis he became associated with some New York City capitalists, who, being friends of Mr. Rowland, conferred with that gentleman in reference to the feasibility of the scheme, deciding that if, upon consideration, the water gas part of it seemed practicable, they would institute a sydicate, with sufficient capital to test it. The result was the erection, by Mr. Rowland, of the works described in the Journal of the 18th ult., of a capacity equal to the manufacture of 500,000 cubic feet per day, and the result of the test was the Company now known as the Municipal Gaslight Company, to whom M. Stern has sold all his interest, as far as New York City is concerned, in the Tessié du Motay and other patents of the system belonging to him, retaining only a stock interest in the Gas Company, but still holding title to the patents in all other territory of the United States.

In the first place we may remark that the new works on plan, without regard to dimensions, follow nearly the same order as shown on the plan of the experimental works already given, with the exception of the superheaters. At the new works there is no isolated apparatus of this sort at all. The practice of heating the air used for raising the carbon charge, in what we shall in future call the gasogenes, to the required temperature, was found by repeated trials at the experimenal works to be unnecessary, and, therefore, forms no part of the process at the new establishment. Consequently, for getting up the heat in the gasogenes, cold air is blown into the closed ash-pits instead of hot. The steam is superheated. This is a very unique affair; certain tubulated iron chambers are set in the partitions that divide all the gasogenes into *two* compartments, and is the invention of M. Jerzmanowsky; in fact, the gasogenes as here shown, and which are found to be great improvements on anything of the sort yet used or suggested, are entirely after his plans. What has just been stated fully accounts for the non-occupation of any portion of the area of

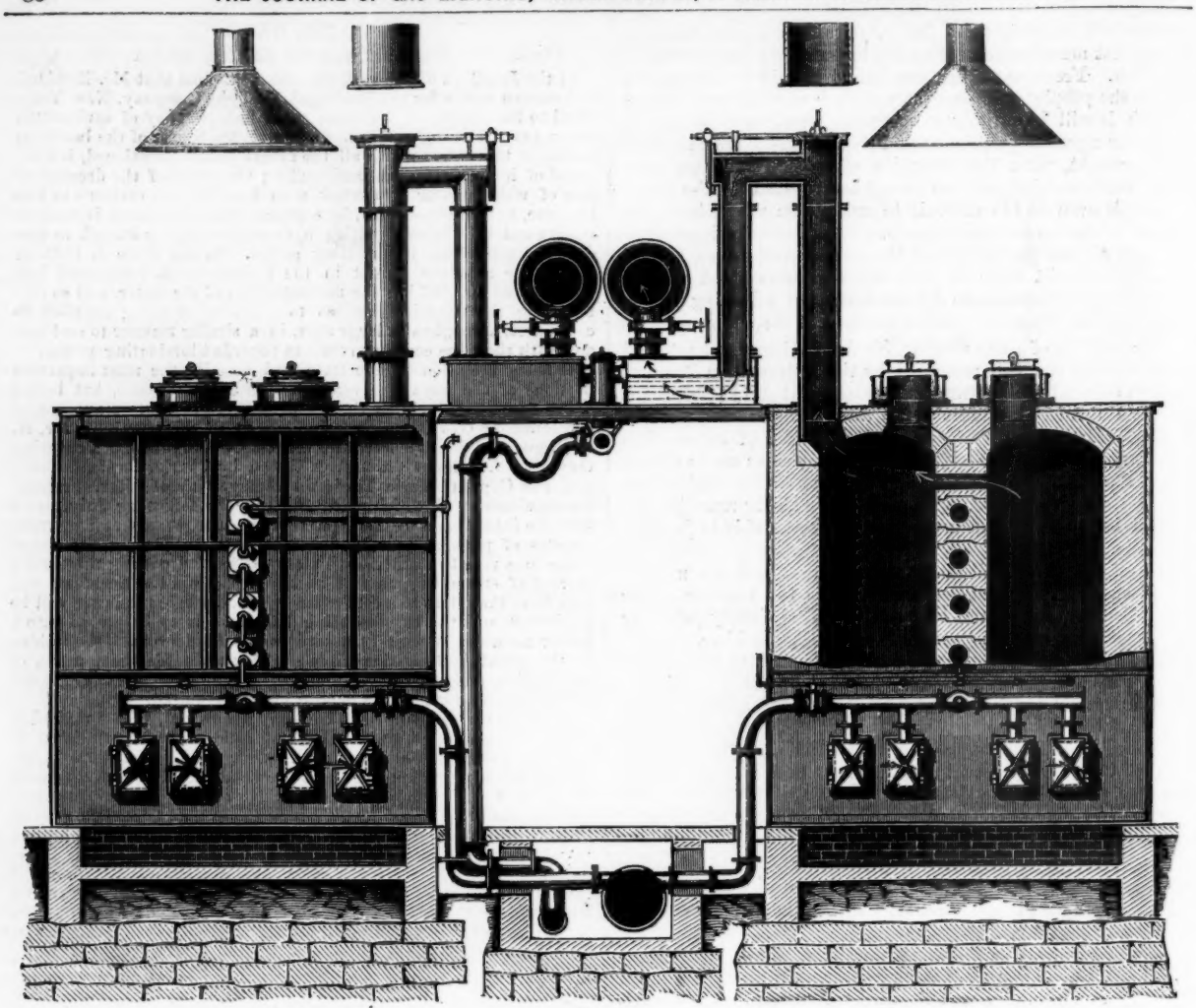


FIG. 8.

the works by superheaters; consequently, as there is no apparatus intervening between the steam-boilers and the gasogenes, we shall at once pass to them, as there the process of manufacture first begins.

The gasogene-house contains ten of these generators, in two rows, with a clear space around each on the ground-floor, but bridged over from one to the other above, in order that the attendants shall be able to pass from top to top for the purpose of lifting the covers of the openings through which coal is supplied as required, also for opening and closing the valves on the stand or connecting-pipes—a matter that requires some attention, as all the valves of the gasogenes under the blast must be open, while those under steam are required to be shut.

Fig. 8 shows two of these generators. The one on the right is in part section, showing the upper portion of the compartments, and the party wall in which are set the superheaters, and through which are the openings to admit of the flow of gas from the right-hand compartment to the left, and away through the stand-pipe to the water-box; or, if the gasogene is under the blast, to allow the products of combustion to flow from right to left, and up the stand-pipe (the valve being open) to the funnel that takes them to the open air. The compartments have a capacity of over 130 cubic feet each, and when in operation are kept filled with anthracite, as high as the openings in the partitions that connect one compartment with the other.

The gasogenes are gas-tight iron cases, lined with fire-resisting material, a space being left between the iron and the brick lining for the reception of a non-conductor of heat. A "grate" surface or "hearth" of refractory material is formed over each ash-pit, on what may be called the ridge and furrow principle—the furrow being a slot the length of the ash-pit. It is of sufficient height above the floor of the house to allow of the ash-pits beneath for the reception of ashes and clinkers, both of which find their way there pretty readily, because of the peculiar construction of the grate. The gasogenes, having a clear space all round them, admit of free access to both ends of the ash-pits, the doors of which are gas-tight when shut—their position, except when removing the ash and clinker. When the blast is on, the air is delivered underneath the fire-grate at both ends of the ash-pits, by pipes that branch right and left from the air-main; but the steam, when all is ready for it, blows in at several places above, and where the carbon is at the highest point of ignition. In order to ensure a through occupation of the sectional area of the charge in the gasogene, the gas formed is made to escape under pressure. The direction is indicated by arrows. The bridge-pipes, one of which is seen in section, are lined throughout with fire-proof material, and their dip-ends are immersed to a

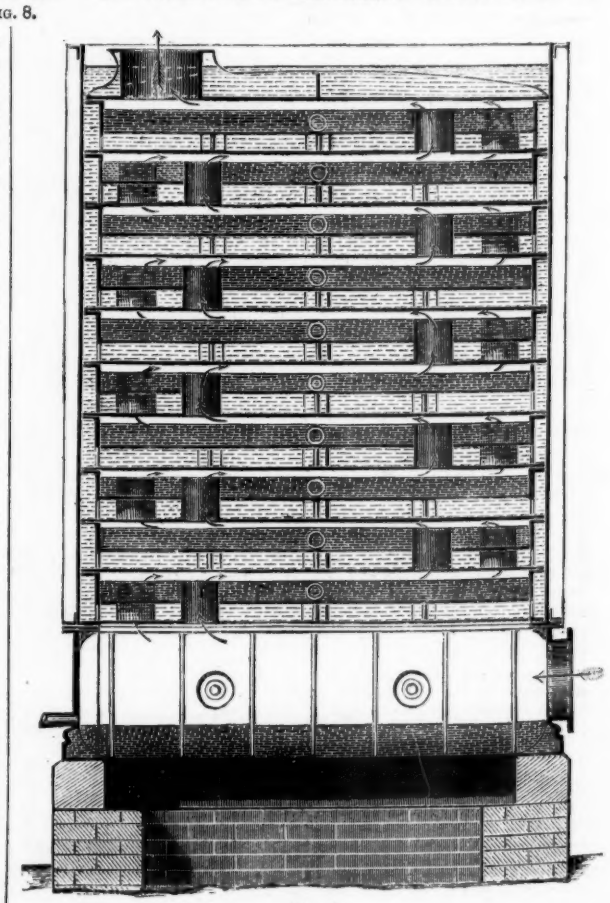


FIG. 9.

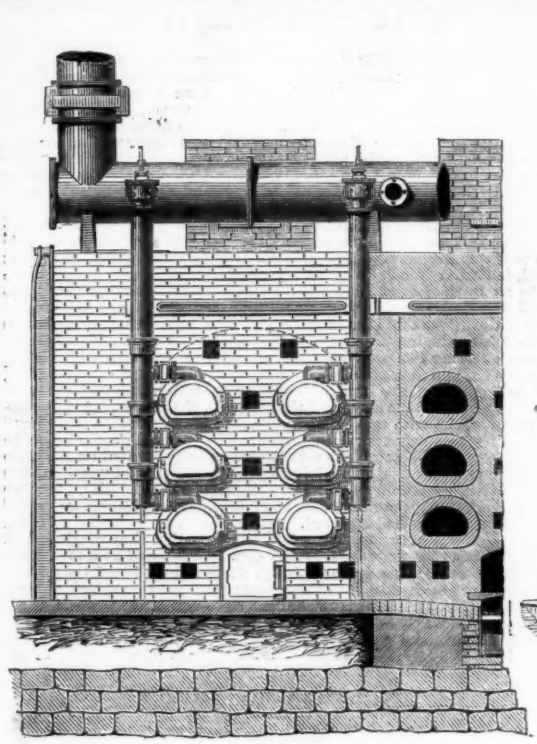


FIG. 10.

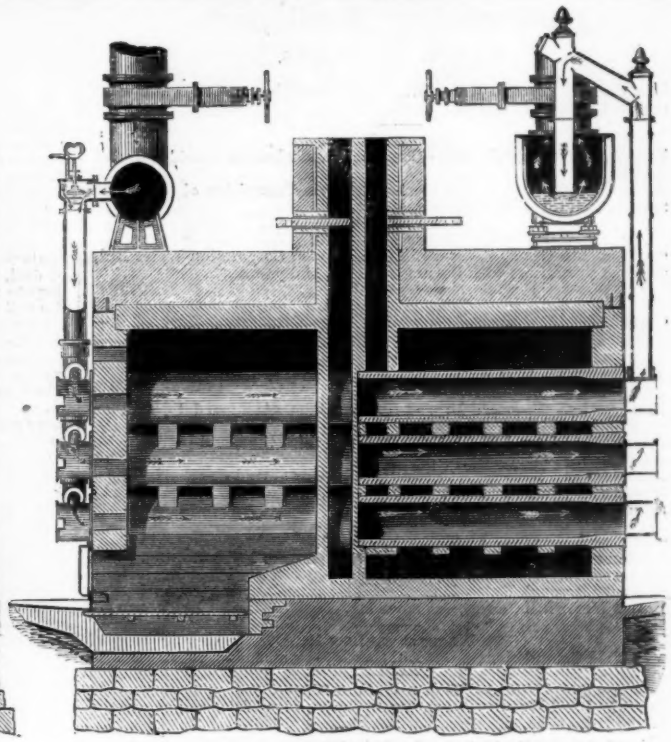


FIG. 11.

depth of 5 inches in the water contained in a box, also shown in section. Attached to their immersed ends are perforated discs for the commingling of the gas and water, the former at this point being very hot, and also containing particles of dust brought over by the current. These, as well as the heat, the water helps to remove. The gas, being cooled, is passed into a holder, from which it is sent to the carburetters for receiving its complement of luminous matter, and to the retorts for the roasting. The particulars of this we shall by-and-by describe.

Each gasogene has openings on the top for replenishing with coal, which is required every two or three hours. These openings are made gas-tight by heavy cast-iron covers, the edges of which, when down, dip into an annulus filled with sand. The contents of certain gasogenes being in the proper condition of heat, steam is turned on until a given pressure is indicated within each of these vessels. This is continued for about fifteen minutes, a period found in practice to be as long as a well-ignited charge can effect the decomposition of the superheated vapour, the cooling influence being very great. During this time the carbon in other gasogenes is being re-ignited by the blast, and made ready to receive steam, thus alternating at about equal intervals of time.

Although at these works the raw gas can be passed through the purifiers on its way to the holder intended for the reception of the gas while in the non-luminous state, it is not usually so worked, practice having indicated that the purification should take place after the roasting, and, therefore, it passes from that process to the purifiers, and from thence to the holders for storing and distribution; consequently there are pipes to allow of this preferred routine being observed. On the plan of the works, four gasholders of 375,000 cubic feet each are shown, and one of 125,000 cubic feet. The last is what we have spoken of as the receiver of the "raw" gas. From this holder the gas is sent forward to the carburetting house and the retorts which follow.

The carburetters, one of which is shown in sectional elevation in fig. 9, consist of a series of cast-iron boxes so placed over each other that naphtha, or any similar carburetting agent, being allowed to flow into the top one, a depth of, say, 4 inches will be attained in all, because the efflux from one to the next below it, and so on, takes place over the ends of the tubes through which the gas passes upwards to, and out of, each chamber, in order that it shall mingle with and bear off the vapour evolved therein. The ends of these tubes, in this case, stand 4 inches above the bottoms, and therefore act as weirs to regulate the depth of the carburetting medium. Accordingly, the lowermost overflows into a chamber in the base of the apparatus, if the inflow at the top is greater than the absorption by the gas under carburization. The boxes being encased, they all become submerged when the case is filled with water, and as the water can be heated by steam to any degree within the range of the boiling point, no difficulty is found in keeping a temperature of from 160° to 180° Fahr., which is about the range required for the creation of the vapour, in proportion to the quantity of gas flowing over the surfaces of the fluid, in order to produce a gas from 22 to 24 candle power pretty regularly. This water bath is a very important and at the same time care-demanding adjunct, especially when we consider that about five gallons of naphtha have to be vaporized for every 1000 cubic feet of gas that requires carburetting, and that this has to be done sometimes at the rate of 100,000 cubic feet per hour. The gas having now the naphtha in it, but being in such a condition that a little lowering of the temperature would throw down a considerable amount of the imbibed vapour, and cause the loss of the illuminating power due to it, it must, from this point to the retorts, be taken great care of to prevent this.

We now come to the department where the gas is said to be roasted or fixed. There we recognize settings of through retorts slightly modified, at one end in particular, for this special work, as shown in elevation, fig. 10. These retorts are partially filled with fire-brick, or any other refractory material, so as to break the current of gas into minute streams, and by their attrition to arrest any particles of lamp-black which might result from the retorts being too hot. The gas enters the retorts at the end shown in elevation. Here will be seen a valve to each mouthpiece, for regulating the flow or quantity of gas that is to pass, in a given time, through the retorts to the hydraulic main at the other end of the benches, as seen by the arrows in fig. 11. Great care respecting the temperature of these retorts has to be observed, or the balance of naphtha is destroyed. If the heat is too high, soot is formed; if too low, the naphtha vapour is unfixed, thereby undoing by one process what had been, through much care, accomplished by a former one. A good heat having been obtained (a bright orange in daylight), and a steady firing maintained, a pretty uniform condition of the retorts can be procured by regulating the amount of gas to the power of each retort, by the valve on the mouthpiece, so that the retorts in a setting that have a tendency to get hotter than others are kept down by having an extra amount of work assigned to them, as is ordinarily the case when charged with coal. The bench of retorts in section, fig. 11, shows the gas entering the retorts on the left, or at that end shown in elevation, fig. 10, which, after passing through the igneous mass of material contained in each (though not shown) passes off to the hydraulic main as indicated by arrows. The exhausters now take effect, and send the gas through the purifiers charged with lime, for the removal of the sulphuretted hydrogen and carbonic acid. From this point there is nothing different from ordinary coal gas, the storing and distributing being in every respect the same.

GAS LIGHTING IN RUSSIA.—A friend in St. Petersburg sends us the following:—"*Towns in Russia lighted with Gas:* St. Petersburg and Islands (four works); Moscow, Warsaw, Cronstadt, Tiver, Kharkoff, Odessa, Taganrog, Kieff, Kazan, Saratoff, Rostoff, Revel, Riga, Vilna."

HINCKLEY GAS COMPANY.—The Directors report for the year ending Lady-day last shows that the receipts were £3708, the net profit amounting to £1209. During the year considerable additions were made to plant, the entire cost of which was met by a call of 15s. per share in December last. A reduction of 5d. per 1000 feet had been made in the price of gas. The Directors recommended a dividend of 11s. 6d. per share, equal to 8¼ per cent. for the twelve months.

BOLTON CORPORATION GAS SUPPLY.—At the meeting of the Bolton Town Council, last Wednesday, the following report by Mr. Harrison Veevers, the Engineer and Manager of the Gas-Works, to the Gas and Lighting Committee was presented:—"In the year ending the 30th of June (which is the end of the financial year) the quantity of gas made was 407,380,000 cubic feet from 39,204 tons of cannel and coal, averaging 10,391 feet per ton. In the previous year the quantity made was 420,836,000 feet, made from 38,929 tons of cannel and coal, or an average of 10,810 feet per ton. The difference in the total quantity of gas made is a decrease of 13,456,000 feet from the previous year's make, or at the rate of 3·19 per cent. The average illuminating quality of the gas during the year was a little over 18 candles; during the previous year it was 16½ candles."

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, JULY 8.

Bournemouth Gas and Water Bill, Cheltenham Corporation Water Bill,—reported with amendments.

TUESDAY, JULY 9.

East Retford Borough Bill.—Commons amendments considered and agreed to.

Public Health (Ireland) Bill,—considered in Committee of the whole House, and reported without amendment.

THURSDAY, JULY 10.

Bournemouth Gas and Water Bill, Cheltenham Corporation Water Bill,—read the third time, with the amendments, and passed.

FRIDAY, JULY 12.

Castleford and Whitwood Gas Bill, Exeter Corporation Water Bill.—Commons amendments considered and agreed to.

HOUSE OF COMMONS.

MONDAY, JULY 8.

East Retford Borough Bill.—Lords amendments agreed to, with an amendment.

Warrington Water Bill (Lords),—read the third time, and passed, with amendments.

Castleford and Whitwood Gas Bill (Lords),—as amended, considered.

Exeter Corporation Water Bill (Lords),—as amended, considered; amendment made.

TUESDAY, JULY 9.

Weston-super-Mare Improvement Commissioners Bill.—Lords amendment agreed to.

Newbury Borough Extension Bill.—Lords amendments agreed to.

Forfar Water Bill (Lords),—as amended, considered.

WEDNESDAY, JULY 10.

Mansfield Commissioners Gas Bill (Lords),—as amended, considered.

THURSDAY, JULY 11.

Castleford and Whitwood Gas, Exeter Corporation Water Bills (Lords),—read the third time, and passed, with amendments.

LOCAL GOVERNMENT AND THE GAS AND WATER SUPPLY OF THE METROPOLIS.

Sir U. KAY-SHUTTLEWORTH asked the Secretary of State for the Home Department, with reference to his announcement before Easter of certain Government measures relating to the Gas and Water Supply of the Metropolis and to the report of the Metropolitan Fire Brigade Committee, and to other matters connected with London Government, whether he proposed to introduce any of these measures during the present session; and, if so, when; and, if not, whether he could assure the House that Her Majesty's Government intended to deal with these subjects in the next session.

Mr. CROSS said he was sorry to be only able to give an unsatisfactory answer to the honourable baronet. He had looked through the "announcement" to which reference had been made, and failed to find that he ever stated that the Government would introduce certain measures relating to the Metropolis. He merely stated that these matters were worthy of the consideration of the House. He had certainly no hope of introducing any measure this session, and it was rather too early to make any statement as regarded next session.

SOUTHWARK AND VAUXHALL WATER COMPANY'S SUPPLY.

Sir U. KAY-SHUTTLEWORTH asked the President of the Local Government Board whether his attention had been called to recent complaints of South London newspapers on the subject of the insufficient supply given by the Southwark and Vauxhall Water Company in Peckham, Bermondsey, and other parts of their district, and to the accounts of an extensive and destructive fire in Peckham on the 22nd of June, when, owing to the short supply of water, the Fire Brigade could not get two steam fire-engines, which arrived shortly after the fire broke out, to work for some time; whether he had caused any remonstrance on the subject to be addressed to the Water Company; whether the Metropolitan Board of Works had taken any action; and whether, considering the numerous and long-continued complaints from this densely populated district, and the repeated cases of insufficiency of supply, the Local Government Board were prepared to encourage an application to them (under section 11 the Metropolis Water Act, 1871) to require the Company to provide a constant supply.

Mr. SCLATER-BOOTH said his attention had been called generally to the complaints in respect of the water supply in these populous districts of London; but he had only received within the past few months two formal complaints with which it was possible to deal. An inquiry had been made as to the cause of the complaints, and the reasons given were that the short supply of water was due to defective fittings and inadequate accommodation in the houses. As to the fire, there was a delay of half an hour owing to the deficient supply of water; and in answer to the complaint the Company stated that the turncock, who lives near where the fire was, was not called upon to give assistance, nor was any complaint made to the office of the Company although only a short way off. There were many difficulties attending the furnishing of a constant supply of water, and it was not for him to encourage applications being made for the provision of such a supply; but he should be perfectly ready to deal with such applications if they were made.

FRIDAY, JULY 12.

POLLUTION OF RIVERS.

Sir U. KAY-SHUTTLEWORTH asked the President of the Local Government Board whether he could inform the House, regarding the Rivers Pollution Prevention Act, 1876, how many summary orders requiring offenders to discontinue pollution had been made by county courts; in how many cases Local Authorities have taken proceedings to enforce the Act; and in what parts of the country the Act had been put into operation.

Mr. SCLATER-BOOTH said he could not say exactly how many summary orders requiring offenders to discontinue pollution had been made by county courts under the Act of 1876, nor in how many cases Local Authorities had taken proceedings to enforce the Act; but proceedings had been instituted in many districts. In three cases the Inspectors had received applications for certificates that all practical means had been adopted to prevent pollution, but these certificates they had refused to give. In eight cases, applications had been received for extension of time to do the necessary work, and in three, extensions had been granted. He stated the other day that proceedings were being taken under the Act in several counties, of such varying characteristics, that it might be said the Act was in general operation.

Legal Intelligence.

CHELMSFORD ASSIZES.—WEDNESDAY, JULY 10.

(Before Baron CLEASBY, *and a Special Jury.)*

WALKER *v.* THE GASLIGHT AND COKE COMPANY.

Serjeant PARRY, Mr. WILLOUGHBY, and Mr. CRISP, appeared for the plaintiff; Mr. WILLIS, Q.C., and Mr. PAYNE for the defendants.

This cause, the hearing of which occupied two days, was an action to recover damages for injuries alleged to have been suffered by the plaintiff through the negligence of the servants of the defendants. The cause was originally tried at last Spring Assizes, when the plaintiff obtained a verdict for £1050. It was now sent for a second trial, on the ground that certain matters had come to light since the first hearing. The accident occurred on July 16, 1877, when the plaintiff, a labourer, was engaged at the defendants works at Bromley-by-Bow, and when some "deals," or heavy planks of deal, fell from a height of nearly 22 feet upon him. There was no dispute as to the fact of the accident, nor that the plaintiff was injured, the real dispute being as to the nature and extent of the injuries. The case for the plaintiff was that it had caused serious and permanent injuries to the spinal cord, producing a paralytic affection of the left side from the neck downwards, fixing the neck painfully in one position, and also producing great emaciation and complete prostration of mucular power and energy. The case for the defence was in substance that there was no paralysis at all and no permanent injury, and that though, if the symptoms described were genuine, the case was serious, the symptoms described were for the most part feigned or greatly exaggerated. The medical evidence was very contradictory on this point, the new trial was partly granted on the ground that at the previous trial the plaintiff had been guilty of "malingering," and the defendants undertook not to dispute their liability. The only question, therefore, was what amount of damages the plaintiff was entitled to for the injuries he had received.

Baron CLEASBY, in summing up, told the jury that they must deal with the case without any reference to the former trial, and as if it had never been tried before. The learned Judge further told them that the only question was as to the amount of compensation; but that raised a question as to the nature of the injuries sustained, as to which there was a singular conflict of opinion.

The jury returned a verdict for plaintiff—damages, £1100.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

Dr. Whitmore's reports on the illuminating power, pressure, and quality of the coal gas consumed in the parish of Marylebone during May and June, and supplied by The Gaslight and Coke Company.

MAY.	Illuminating Power in Sperm Candles.			Mean Pressure in Tenths of an Inch.		Mean Quanty. of Sulphur in 100 Cu. Ft.	Mean Quanty. of Ammon. in 100 Cu. Ft.	Sulphuretted Hydrogn.
	*Mean of 24 Obser.	Highest.	Lowest.	Highest.	Lowest.	Grains.	Grains.	
Gas supplied from the Fulham works . .	16·81	17·14	16·46	20·96	9·56	14·53	0·33	No trace
Gas supplied from the Beckton and Bow works	16·95	17·40	16·41	39·61	19·00	10·00	0·23	No trace
Cannel gas supplied from the Pimlico works	20·91	21·81	19·84	25·21	12·71	13·56	0·07	No trace

Mean of daily readings of barometer . . . 29·57
" " " thermometer . . . 61·99

JUNE.	*Mean of 23 Obser.							
Gas supplied from the Fulham works . .	16·86	17·34	16·03	21·05	9·46	14·34	0·33	No trace
Gas supplied from the Beckton and Bow works	16·98	17·41	16·68	35·61	18·78	10·13	0·20	No trace
Cannel gas supplied from the Pimlico works	21·09	22·91	20·54	28·94	14·70	13·06	0·20	No trace

Mean of daily readings of barometer . . . 29·83
" " " thermometer . . . 67·18

*Each observation consists of ten readings of the photometer, at intervals of one minute.

The mean illuminating power of the three gases consumed in the parish during the month of May was well over the standard. The Fulham gas exceeded 17 candles on nine occasions, and the Beckton and Bow gas on eleven occasions. Eleven times the cannel gas exceeded 21 candles. The mean amount of sulphur found in 100 cubic feet of the Fulham gas was 14¼ grains, in the Beckton gas it was 10 grains, and in the cannel gas 13½ grains. Virtually there was no ammonia. The pressure of all the gases was satisfactory, and on no occasion was sulphuretted hydrogen detected by the ordinary tests. The mean illuminating power of all the three gases consumed in the parish during the month of June was unusually high. In every one it was nearly a candle above the legal standard, and on no occasion did it fall below the standard. Eight times the Fulham gas exceeded 17 candles; eleven times the Beckton and Bow gas exceeded 17 candles; and seventeen times the cannel gas exceeded 21 candles. The mean quantity of sulphur found in 100 cubic feet of the Fulham gas was 14·34 grains, in the Beckton and Bow gas it was 10·13 grains, and in the cannel gas 13 grains. Practically no ammonia was present. The pressure of all the gases was good, and no trace of sulphuretted hydrogen was at any time found in either of them by the ordinary tests.

METROPOLIS WATER SUPPLY.

Dr. Frankland reports, as the result of his analyses of the waters supplied to the Metropolis and some of its suburbs during June, that, taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, to represent unity, the proportional amount of such impurity in an equal volume of water supplied by each of the other Companies and by the Tottenham Local Board of Health was:—Tottenham 1·3, Kent 1·4, Colne Valley 1·6, New River 4·2, Chelsea 4·3, East London 4·3, Southwark 4·4, Grand Junction 5·5, West Middlesex 5·6, and Lambeth 5·6. The Thames and Lea were much swollen by heavy rains, and the water drawn from these rivers by seven out of the eight Companies supplying London was so much polluted by organic matter as to be unfit for dietetic purposes. Such intense pollution rarely occurs in summer, and the Southwark, Grand Junction, East London, and New River Companies seem to have

been unprepared for it, as they failed to filter the water effectively before delivery. The supplies of all these Companies were slightly turbid when drawn from the mains, and moving organisms were found in the Southwark and Grand Junction Companies waters. The deep well water delivered by the Kent and Colne Valley Companies, and by the Tottenham Local Board, was unaffected by the rains; it was bright, wholesome, palatable, and of its usual excellent quality. Seen through a stratum 2 feet deep, the water supplied by the Kent and Colne Valley Companies, and by the Tottenham Local Board, was clear and colourless; the New River and East London Companies water was slightly turbid and very pale yellow; the Chelsea and Lambeth Companies water was clear and pale yellow; that supplied by the West Middlesex Company clear and yellow; and that by the Southwark and Grand Junction Companies slightly turbid and brownish yellow.

Results of Analysis expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Matters.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen, as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Total Hardness.
Inner Circle.								
Thames—								
Chelsea	28·22	·218	·037	0	·105	·142	1·4	18·8
West Middlesex	27·58	·278	·059	0	·119	·178	1·4	19·4
Southwark	29·08	·249	·034	0	·147	·181	1·4	20·6
Grand Junction	29·16	·300	·028	0	·144	·172	1·4	19·7
Lambeth	30·12	·296	·038	0	·168	·206	1·4	20·6
Other Sources—								
New River	26·56	·217	·054	0	·162	·196	1·5	19·4
East London	28·20	·243	·033	0	·138	·171	1·8	20·8
Kent	42·56	·067	·020	0	·474	·494	2·5	27·5
Outer Circle.								
Colne Valley	20·02	·071	·026	0	·308	·334	1·4	12·3
Tottenham Local Board	47·22	·061	·020	0	·427	·447	3·5	27·8
Corporation of Birmingham*	24·90	·143	·073	·003	·198	·273	1·9	14·5
Corporation of Glasgow†	2·70	·120	·015	0	·005	·020	0·5	1·2

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
† Analyzed by Dr. E. J. Mills, F.R.S., of Anderson's College, Glasgow.

Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

The Registrar-General publishes the following returns of the average daily quantity of water supplied by the London Water Companies during the month of June, 1878. According to these, 130,142,204 gallons, or 591,296 cubic mètres of water (equal to about as many *tuns* by measure, *tons* by weight) were supplied daily; or 239 gallons (108·6 decalitres), rather more than a *ton* by weight, to each house, and 33·6 gallons (15·3 decalitres) to each person, against 35·0 gallons during June, 1877.

Companies.	Number of Houses, &c., supplied in June, 1877.	Number of Houses, &c., supplied in June, 1878.	Aver. Daily Supply of Water in Gallons* during June, 1877.	Aver. Daily Supply of Water in Gallons* during June, 1878.
Total supply	533,440	545,040	132,570,858	130,142,204
From Thames	250,780	257,916	67,349,512	65,215,281
„ Lea and other Sources	282,660	287,124	65,221,346	64,926,923
THAMES.				
Chelsea	28,741	29,014	8,554,600	8,726,500
West Middlesex	49,372	50,766	11,993,533	10,571,009
Southwark and Vauxhall	78,297	80,785	19,120,000	19,400,000
Grand Junction	37,683	38,462	12,588,979	12,698,372
Lambeth	56,687	58,889	15,093,000	13,819,400
LEA AND OTHER SOURCES.				
New River	125,261	126,725	29,254,000	28,461,000
East London	111,967	115,143	27,642,400	28,120,970
Kent	45,432	45,256	8,324,946	8,344,953

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for June, 1878, as compared with that for the corresponding month of 1877, shows an increase of 11,600 houses, and a decrease of 2,428,654 gallons of water supplied daily.

Dr. Whitmore's reports on the composition of Thames Companies and other waters supplied to Marylebone during May and June:—

May.	In Grains, per Gallon. Total Solid Matter.	In Grains, per Gallon. Loss by Incineration.*	In Grains, per Gallon. Chlorine.	In Parts, per Million. Free Ammonia.	In Parts, per Million. Albuminoid Ammonia.	In Degrees. Hardness.	In Degrees. Hardness after boiling Fifteen Minutes.
West Middlesex	18·90	0·90	1·06	0·00	0·07	12·8	2·6
Grand Junction	19·00	0·90	1·10	0·01	0·07	12·9	2·7
JUNE.							
West Middlesex	18·70	0·70	1·02	0·00	0·06	12·6	2·5
Grand Junction	19·00	0·80	1·04	0·00	0·07	12·9	2·6

* The loss by incineration represents the amount of organic and other volatile matters contained in the Imperial gallon (70,000 grains) of water. The total solid matter, *minus* such loss, consisted largely of carbonate of lime, with small quantities of other equally harmless salts.

The water during May, as drawn from the mains, was perfectly clear and well filtered, and no living organisms could be detected in it. A sample of water, as taken from the River Thames at Hampton, was slightly turbid. The water supplied to the parish by both the Water Companies during June was of full average purity. It was clear, bright, and well filtered, and no living organisms were detected in it by the microscope.

HALIFAX CORPORATION WATER-WORKS.

[From the *Halifax Courier*.]

The new reservoir at Widdop will add to the town's supply two and a half million gallons per day. Besides this, 1,620,000 gallons per day are to be allowed as compensation to the mills. The lake has an area of 2223 acres, and a capacity of 654,000,000 gallons. Its area is almost double, and its capacity almost triple that of Ogden, which is the next largest reservoir owned by the Corporation. The expenditure upon the works to the 1st of June, exclusive of a proportion of the general charges, was £118,464. In addition, there had been spent at the same date on the main conduit, £26,602; on the Castle Carr tunnel, £31,238; and on the Castle Carr syphon (now being constructed), £1888. These last are works necessary to connect the new source of supply with the system in the Luddenden Valley.

Widdop reservoir, constructed on the Widdop Stream, receives also, by means of a tunnel, the waters of the Greave Clough or Valley. The drainage area is 2223 acres, of which some 800 acres are in the Widdop Valley, the highest point being 1700 feet above the sea level, while the altitude of the reservoir is about 1100 feet. As the site is the top part of the Widdop Valley, only one embankment has had to be formed. Simple as this may appear, it has been a very expensive work. The trench had to be cut a depth of about 40 feet in the middle, and 80 feet at the ends. From the lowest ground line the embankment rises to a height of 75 feet—the total height from the bottom of the trench being 115 feet. The bed of the trench is laid 5 or 6 feet thick with concrete of most solid character. The valves for the discharge of the water are so arranged that the water can be drawn at different levels.

The conveyance of the water for miles through hills and across the valleys has been a work of great magnitude and cost, as will be seen from the figures given above. The water is first of all discharged from the reservoir in iron pipes. It then passes in a tunnel (half a mile long) under the Ridge to Holme End Bridge in the Walshaw Dean Valley. The tunnel at the deepest point is 80 to 100 feet below the surface. After skirting the hills to Crimsworth Dean, it crosses the valley, at a depth of more than 200 feet, in cast-iron syphon pipes, and then, at Pecket Well, enters the Castle Carr tunnel (2500 yards long) which passes under Wadsworth and Midgley Moors. The Luddenden system is joined at Shore End Wood. The aqueduct communicating from the Ridge tunnel with Shackleton is 4 feet high and 2 feet 6 inches wide, and is capable of conveying 10,000,000 gallons per day. It is of concrete, composed of four parts of stone and sand and one of lime, and varies in thickness from a foot to half a yard. The Castle Carr tunnel, for which Mr. John Parkinson was the contractor, is at one point 500 feet below the surface. Messrs. Bateman and Hill have been the Engineers for the works, which have been carried out under the personal supervision of Mr. Paskin, the Resident Engineer. Most of the work has been done by day labour.

The general water-works system of the borough resembles in the line of conduits a tree. The trunk reaches from the town to Ramsden Wood reservoir. Thence a branch extends to Ogden. Another branch reaches from Ramsden Wood to Warley Moor up the Luddenden Valley. The Widdop works branch off from the Luddenden system at Shore End Wood; and the proposed three reservoirs at Walshaw Dean, having about the same capacity and drainage as the Widdop reservoir, will be connected by a conduit with the Widdop system at Holm End Bridge.

At the head of the Ogden branch is Ogden reservoir, on the Hebble stream. It receives the drainage of 1140 acres, and has a capacity of 221,806,000 gallons. 990,000 gallons have to be discharged daily down the stream in compensation. The conduit passes hence through Mixenden, where there is another reservoir with a drainage area of 190 acres. The main supply of the Mixenden reservoir is, however, the surplus water from Ogden. It has a capacity of 106,121,000 gallons. The water hence is conveyed under Mount Tabor by a tunnel, and is emptied into the Ramsden Wood reservoir, which has a capacity of 11,700,000 gallons. The town's supply from the Hebble Valley is 1¾ million gallons per day.

The Luddenden system derives its supply from the Luddenden Brook. At the head of the stream (1350 feet above the sea level) is the Fly reservoir, with a capacity of 193,250,000 gallons, and a drainage area of 919 acres. Near to Castle Carr are the Upper and Lower Dean Head reservoirs, constructed with ornamental basins. They contain respectively 59,142,000 gallons and 63,011,000 gallons, and represent a drainage area of 525 acres. The Luddenden mills receive 1,440,000 gallons of water per day in compensation. Before leaving the Castle Carr Valley the conduit receives Stony Spot Spring and Shore End Wood or Back Clough Springs, which are piped across the valley at a point near Low Bridge. The conduit enters the tunnel under Mount Tabor at Shaw Booth, and hence the water passes into Ramsden Wood reservoir. The town's supply from the Luddenden Valley is two million gallons per day.

The present water supply, therefore, is estimated at 3¾ million gallons per day. The Widdop and Walshaw Dean works (the latter not begun) will each add 2½ million gallons, raising the total supply to 8¾ million gallons per day. Though the works cover an enormous area, and have been very costly, several splendid advantages are derived. The whole supply is by gravitation. The watersheds are chiefly moorland of the millstone grit formation—the best natural filter. Thus the water is delivered in the town pure, without need of filtration, and at a high pressure. In addition to the reservoirs mentioned, there are, within the borough, the following service reservoirs of the capacity named:—Albert, 28,464,329 gallons; Victoria, 12,731,643 gallons; Hanson Lane, No. 1, 3,290,454 gallons; Hanson Lane, No. 2, 2,445,062 gallons; Gibbet, 34,207 gallons; Old Cock Yard, 11,118 gallons.

The table below shows the cost of all the works, including mains, services, and meters, on the 31st of December last:—

	£	s.	d.
Old works	28,976	5	4
Ogden reservoir	16,907	12	5
Ramsden Wood reservoir	5,965	1	1
Catch-water drain	3,108	17	0
Pure-water conduit	15,560	10	0
Reconstruction of conduit	6,232	16	3
Albert reservoir	20,000	6	9
Mixenden reservoir	29,183	7	7
Luddenden works	148,954	3	0
Widdop reservoir	115,593	16	9½
Main conduit	26,602	10	0
Castle Carr tunnel	31,238	1	0
Castle Carr syphon	1,424	14	2
Huts, &c., at Widdop	416	14	10
Telegraphs	600	0	0
General charges, engineer's and parliamentary expenses	31,508	16	9
Land—Royles Head	603	15	10
Property in Hebble Valley	4,745	7	1
Buckley Lane Farm	140	14	2
Mains, services, and meters	79,433	11	4½
Interest on non-productive works authorized by Act, 1876, to be repaid in 15 years	40,000	0	0
Total	£607,197	1	5

This total, with £16,751 2s. 3d. interest on suspense account, had been swollen on June 1st to £627,116 12s. 6d., which may be taken as representing the cost of the works to that date. The borrowing powers on water account (including the Walshaw Dean scheme) are for £850,000; the amount actually borrowed is £615,590. The Corporation are at present taking the needful steps for making a small service reservoir at Royles Head, to supply Highroad Well and other upper parts of the borough.

BRITISH ASSOCIATION OF GAS MANAGERS.

(*Continued from p. 60.*)

TUESDAY, JUNE 18.

Mr. C. HUNT (Birmingham) read the following paper on

PREVENTABLE WASTE.

It is probable that few manufacturing processes are conducted without a certain amount of waste. When, however, as is said to be the case in the manufacture of iron or of metallurgical coke, this is not avoidable by any known methods, the manufacturer may, with untroubled conscience, pursue his way to further improvements; but when, as with coal gas, such waste, either in the process itself or in the consumption of the manufactured article, is strictly of a preventible nature, with our regrets at its occurrence must be mingled a feeling of something like self-reproach.

It was estimated by the Royal Coal Commission in 1867-68, that the annual consumption of coal within the United Kingdom for gas-making purposes amounted at that time to 6,500,000 tons. Allowing for an increase since then at the moderate rate of 3 per cent. per annum compound, it would appear that the total yearly consumption cannot now be less than 8,500,000 tons. Of this fully one-fourth, or, to be well within the mark, say 2,000,000 tons, representing a cost to carbonize of not less than £1,500,000 annually, may not unfitly be described as preventible waste.

This undesirable condition of things is brought about by very simple means. Pressure within the retort at the moment of evolution, and this same pressure injudiciously exerted at the point of combustion, is directly responsible for by far the largest share; while neglect of the necessary precautions for the efficient maintenance of the distributing apparatus frequently, by the loss which it occasions, operates as a serious check upon the profitable development of gas undertakings.

In submitting a few observations, with the object of pointing out some of the ways by which this enormous annual loss may be diminished, I am aware that I am treading upon ground which has been rendered familiar by the labours of many of our members, and am conscious of the difficulty of finding fresh matter for discussion; yet I trust that some good may result from a periodical recurrence to the subject, and from an endeavour to show that, great as may have been the improvement during the last few years, there is yet room for the exercise of considerably more economy than generally prevails.

In the first place, then, what proportion of this loss may be attributed to the carbonizing process, as ordinarily conducted? We usually gauge the success of this operation by the yield of gas per ton, regard being had to its illuminating power; and there can be no question as to the value of this as a method of comparison. But it is clearly impossible, in this way alone, to determine the results of our operations; for to do this it is necessary to take into account the whole of the products, and compare them, weight for weight, with the coal whence they were derived. When this is done there will be found, in almost every case, a deficiency, varying in amount according to the degree of skill employed, but never less than 7 or 8, and more frequently 11 or 12 per cent.; while instances are numerous in which as much as 24 per cent. of the volatile products is habitually lost. The following examples, which are, to a considerable extent, drawn, so to speak, from the life, are offered in confirmation of this statement.

No. 1 is an example of probably the highest return yet obtained, where coal only is employed, working in the ordinary way:—

EXAMPLE No. 1.

Newcastle Coal carbonized in London.

	lbs.
10,500 cubic feet of 16½ candle gas, sp. gr. ·461, weigh $\frac{10{,}500 \times 1728 \times (31{\cdot}012 \times {\cdot}461)}{7000 \times 100}$	370·56
10 gallons of tar, at 11·2 lbs. per gallon	112·00
10½ gallons of liquor, at 10·2 lbs. per gallon	107·10
Impurities—	
Sulphuretted hydrogen taken out—say, ¾ per cent. $\frac{78{\cdot}75 \times 1728 \times 36{\cdot}33}{7000 \times 100}$	7·06
Carbonic acid taken out—say, 2½ per cent. $\frac{262{\cdot}5 \times 1728 \times 47{\cdot}26}{7000 \times 100}$	30·62
Ammonia removed after condensation—say, 12 galls., 10 oz. liquor; ammonia, 40 oz. $\frac{12 \times 10 \times 17}{49}$ oz.	2·60
Total volatile products	629·94
Coke—say	1560·00
Total	2189·94
Leaving a deficiency of	50·06
	2240·00

Or $\frac{50{\cdot}06 \times 100}{629{\cdot}94} = 7{\cdot}94$ per cent. of the volatile products.

The second is what may be termed a medium example:—

EXAMPLE No. 2.

Inland Coal.

	lbs.
9,400 cubic feet of 17 candle gas, sp. gr. ·468, weigh $\frac{9400 \times 1728 \times (31{\cdot}012 \times {\cdot}468)}{7000 \times 100}$	336·78
11 gallons of tar, at 11·2 lbs. per gallon	123·20
16 gallons of liquor, at 10·2 lbs. per gallon	163·20
Impurities—	
Sulphuretted hydrogen taken out at purifiers—say, 1½ per cent. $\frac{141 \times 1728 \times 36{\cdot}33}{7000 \times 100}$	12·64
Carbonic acid taken out—say, 2½ per cent. $\frac{237{\cdot}5 \times 1728 \times 47{\cdot}26}{7000 \times 100}$	27·70
Ammonia removed in scrubbers—say, 15 gallons of 12 oz. $\frac{15 \times 12 \times 17}{49}$ oz.	3·90
Total volatile products	667·42
Coke—say	1500·00
Total	2167·42
Leaving a deficiency of	72·58
	2240·00

Or $\frac{72{\cdot}58 \times 100}{667{\cdot}42} = 10{\cdot}87$ per cent. of the volatile products.

And the third is from the bottom of the class:—

EXAMPLE No. 3.

	lbs.
8,300 cubic feet of 17½ candle gas, sp. gr. ·480, weigh $\frac{8300 \times 1728 \times (31{\cdot}012 \times {\cdot}480)}{7000 \times 100}$	304·99
11 gallons of tar, at 11·2 lbs. per gallon	123·20
13 gallons of liquor, at 10·2 lbs. per gallon	132·60
Impurities—	
Sulphuretted hydrogen taken out at purifiers—say, 1½ per cent. $\frac{124{\cdot}5 \times 1728 \times 36{\cdot}33}{7000 \times 100}$	11·16
Carbonic acid taken out at purifiers—say, 2½ per cent. $\frac{207{\cdot}5 \times 1728 \times 47{\cdot}26}{7000 \times 100}$	24·20
Ammonia which should be removed, but more frequently left in, $\frac{15 \times 12 \times 17}{49}$ oz.	3·90
Total volatile products	600·05
Coke—say	1500·00
Total	2100·05
Leaving a deficiency of	139·95
	2240·00

Or $\frac{139{\cdot}95 \times 100}{600{\cdot}05} = 23{\cdot}32$ per cent. of the volatile products.

In calculations of this kind, it is not easy to be strictly accurate; but I have endeavoured to avoid under-estimating the weight of any single product, so as not to fall into the error of over-estimating the deficiency. Where this is as high as in No. 3, the remedy is doubtless to be found in the employment of an exhauster, which is yet a stranger in very many works, and by the aid of which the loss need never exceed 10 or 11 per cent., while, beyond this, a further improvement is practicable by careful attention to the condition of the retorts; but, however well made clay retorts may be, they are always, to a certain extent, porous; and however well they may be set or built, their soundness is of very brief duration. Consequently, it is not to be wondered at that a large proportion of the gaseous matter, which it is our object to secure, finds its way, not up the ascension-pipes, as we would have it, but through the flues, and up the chimney stack, at the top of which, especially if the stack be a short one, its presence is generally indicated by a body of flame, more or less considerable. If any one be disposed to question the origin of this flame, which has, indeed, been attributed to wasteful firing, let him try the experiment for himself of removing all pressure from the retorts, when the simultaneous disappearance of the flame will afford convincing proof of its identity with the gaseous matter produced in the interior of the retort.

Another circumstance, pointing conclusively to the mischievous tendency of pressure, is the formation of carbon, which, without doubt, may be regarded as its natural consequence. Viewed in this light, it may be accepted as no slight proof of the advance that has recently been made in the direction of obtaining fuller value from the coal—that much less is now heard than formerly of the difficulty experienced in scaling retorts, or of the various remedies which ingenuity has devised for getting rid of this troublesome product. It is abundantly manifest that, in regard to this, Gas Managers have it in their power to lend conspicuous illustration to the truth of the proverb, "that prevention is better than cure."

It may, however, be taken for granted that with the dip-pipe, however carefully it is adjusted, a certain amount of pressure is unavoidable; and, inasmuch as even this minimum pressure is to be deprecated, the question which forces itself upon our attention is, Whether or not is the dip-pipe a necessity? It may, without difficulty, be conceded that, if with the highest state of efficiency can be united the greatest possible security and convenience, such a combination is by all means to be promoted and maintained; but when this involves, as in the case before us, the sacrifice of a certain degree of efficiency, we have a perfect right to question its wisdom, and to ask ourselves whether it is worth the cost entailed. Suppose an account were to be regularly rendered to us at the rate of, say, 10d. or 1s. per annum for every ton of coals carbonized, should we not require to write "value received" before passing it for payment? And yet it is very certain that, indirectly, most of us do pay this, and more, year after year, without inquiry or remonstrance, for the use of the dip.

It may, however, be fairly urged that when, by careful attention and periodical adjustment, this inevitable loss is reduced to its smallest dimensions, we do get value for what remains, in the shape of the unquestionable convenience and absolute security which the dip ensures; and the argument would be conclusive if it could at the same time be shown that such conditions are indispensable to successful working, or that they cannot be sufficiently approximated by other means less open to objection on the score of pressure. Many, indeed, there must be who entertain the belief that such is the case, for otherwise it is impossible to account for the almost universal employment of the dip. But of these I would inquire, Have you satisfied yourselves, by personal experience of other systems, that the dip is really indispensable? Unless this question can be answered in the affirmative, it would seem impossible to account for its retention upon any other supposition than that there exists a widespread theoretical assumption of its value; which may be said to savour too much of a blind adherence to custom to entitle it to much respect. And if it be objected that no convenient substitute for the dip has been devised, I need do no more than refer to the example of Cheltenham, where, under successive Managers, the dip has for many years been unknown. The success which has there attended its abandonment seems to point incontestably to the conclusion that, thanks to the introduction of the exhauster, the necessity for its retention has long since passed away.

Intimately associated with this question is the consideration of the effect produced by forcing the gas, as it is generated, through the tar in the hydraulic main. The writer is not in a position to express any positive opinion with regard to this; but it seems highly probable, from the observations of Mr. R. H. Patterson and others, that its contact with tar has the effect of depriving gas of some of its illuminating constituents. At the same time, it is to be observed that the subsequent washing or scrubbing process is an ordeal scarcely less searching in its effect upon the hydrocarbon vapours than that which it would escape by the non-use of the dip; so that, in the absence of proof, it may be safest to omit from the calculation any advantage that might be possible in the direction of an increased illuminating power.

Following next in point of order comes the loss incidental to distribution. Of that which, being due to defective registration, is apparent only, it is unnecessary to say more than that it is remediable almost to the smallest fraction, as the recent experience of the Chartered Company, if it stood alone, would suffice to show, but which experience is abundantly con-

firmed by that of others in all parts of the country. So large a per centage of unaccounted-for gas as 25, 20, or even 15, may be said to point to an indifference on the subject of correct measurement which, in ordinary commercial transactions, would be regarded as simply intolerable, while in the gas manufacturer it is, to say the least of it, somewhat discreditable. Nor can the imperfections of the meter, such as they are, be pleaded in extenuation of such a fault, it being clearly upon record that these are completely under control, rigid supervision being all that is needed to secure, within practical limits, accurate registration.

While it may, without difficulty, be admitted that the principal sources of actual waste incidental to distribution are leaky gasholders, bad joints, and worn-out services, all of which it is within the power of the Gas Manager to remove, it is without doubt an open question as to how far such waste is susceptible of diminution, since a certain proportion is always due to accidental breakages of mains, or to other causes over which the Gas Manager possesses only a limited control; but even such proportion must be regarded as only in a lesser degree preventible, when it is remembered how much can be effected by means of improved arrangements. For instance, the damage done to mains by heavy traffic or unequal subsidence may be minimized by laying them deeper under the ground, and by the employment of larger pipes—small and weak ones, such as 2 inches and 3 inches, being very much more liable to injury than such as are made of heavier metal. In like manner wrought-iron service-pipes may be preserved by coating them with asphalte, or rendered more durable by the adoption of a thicker gauge of iron in their construction. Again, almost absolute immunity from loss from this source may be ensured by the employment of lead pipes; while, according to some, wrought-iron tubes that have been subjected to Professor Barff's process are secure against oxidation for almost any length of time. Too much attention likewise cannot be paid to the jointing of services to main-pipes, which, especially when the latter are thin, is a fruitful source of leakage. It has been said, with much show of reason, that there is no better evidence of the general character of the management of a gas undertaking than is afforded by the condition of the distributing plant, as shown by the per centage of unaccounted-for gas. But, however this may be, it is certain that in no other direction can the Gas Manager obtain a more sure and speedy return for the exercise of ordinary care and vigilance. Instances are numerous of a rapid improvement, under such conditions, to an almost unlooked-for extent. In the case of the late Birmingham Company, for example, the per centage of unaccounted-for gas was, in the short space of three years, reduced from 11 or 12 per cent. to about one-half that amount. All this points to the conclusion that, in this matter, as in others of a similar nature, there is no such thing as finality short of an almost total suppression of even the appearance of waste.

In expressing this opinion I am not overlooking the fact that loss may arise from the action of the law of diffusion of gases, but that this can be anything appreciable, the nature of the material of which our mains and services are made precludes us from believing. A more important element of difference—for loss it is not—is to be found in the variable temperature between the works and the consumers meters, every one degree of variation representing a difference in volume of about one-quarter per cent. This difference is no doubt greatest when the works registration is habitually corrected to 60°, because in the mains the gas is invariably cooler than this by several degrees; but it is probably never more than 1 or 1½ per cent.; and by correcting to a temperature more nearly corresponding to that at which the gas passes through the mains and consumers meters, it can, of course, be made to disappear altogether. Having regard to all the circumstances, it seems impossible to doubt that almost perfect correspondence between the registration at the works and at the consumers meters is possible of attainment; and to this end our efforts should be directed. If our mains and services were laid and maintained, as they might be, almost absolutely gas-tight, we should place ourselves above the necessity for restricting day pressures as a means for diminishing leakage—a most important consideration when it is recollected that, in order to meet the requirements of an extended consumption for heating purposes, we must be in a position to maintain a moderately high pressure throughout the greater part of every 24 hours. If this constant service is to be provided with profit to the manufacturer, it will have to be free from the liability to waste.

The subject of gas-burners is one of recognized importance, and the prodigious loss for which they are directly responsible has very properly been a matter of frequent comment; but it is questionable whether the Gas Manager is to be found who considers himself personally accountable for the imperfect combustion of the gas which he supplies; and hence it is not improbable that objection may be taken to my including this amongst those sources of waste which it is within his power to control. To a certain extent this objection is no doubt a perfectly valid one, although it would not be difficult to show that our influence, if we chose to exert it, must be very considerable indeed; but it is sufficient for my purpose very briefly to refer to the importance of the question as affecting our interests, present and future.

Within a comparatively brief space of time, our knowledge of the condition by which perfect luminous combustion may be secured has been greatly extended; with the result that the best constructed burners of the present day compare very favourably with their predecessors of say 20 years ago, being made to yield fully 40 per cent. more light with the same consumption of gas. Satisfactory as this may be, it is by no means so pleasing to reflect that this improvement is profitless to the general body of consumers, in consequence of the almost universal retention, through ignorance, of the old and wasteful forms of burners; so that if the waste from this source alone were to be set down at 25 per cent., it would be found to be by no means an exaggerated estimate. In proof of this it may be mentioned that at the exhibition of gas-heating apparatus recently held in Birmingham, there was exhibited a series of burners, nearly all of them typical of such as are in daily use. On being tested it was found that the difference between the best and worst was 20·41 against 6·92 candles; showing a loss by the use of the latter of no less than 65·7 per cent.; while an ordinary Argand, considered to be a very good one of its kind, of which there are many thousands in use for illuminating shop windows and similar purposes, gave only 13·42 candles, being a loss of 34·2 per cent.

In fairness to the gas, no less than from economical reasons, such a manifest abuse ought no longer to continue. Complaints of bad gas are freely made, which, on investigation, are usually found to be chargeable to the burner; but it is as a means of reducing the cost to the consumer that the importance of dealing intelligently with this question is most apparent. It may possibly be regarded as an incontestable proof of the incomparable vitality of coal gas, that, notwithstanding such an amount of waste, it has not only stood its ground, but increased in popular favour; but have we any guarantee for the continuance of such good fortune? Are there not, on the contrary, at the present moment, signs of a disposition to dispute with us the occupation of a portion of our domains? We may, it is true, be very far from believing in the probable supercession of coal gas, speedy or remote; but with such disbelief, the endeavour to increase the distance between it and possible competitors is perfectly consistent. In making gas light cheaper, whether by means of improved manufacture or by the reduction of the illuminating power at the burner, we are acting in accordance with the conviction that our interests as the manufacturers are practically identical with those of our customers, than which no policy can commend itself as more likely in its effect to strengthen and confirm our position as the principal purveyors of the means of artificial illumination throughout the civilized world.

I have thus imperfectly referred to what appear to be three of the principal hindrances—for so they may be termed—to the further successful employment of coal gas; for it need hardly be said that, in proportion to its cheapness, so is its use likely to extend, more especially for heating purposes. In this latter direction the field for its employment would seem to be of almost limitless extent.

Mr. CHANDLER said he could confirm from observation every word in the paper just read. The former part of it referred particularly to that objectionable part of the apparatus connected with gas-works known as the dip-pipe, and he might say there were other works besides those at Cheltenham which had proved to demonstration that prevention, with regard to the deposition of carbon in the retorts, was better than cure. He had in his mind's eye, just now, some works, situated somewhere in Surrey, where patent dip-pipes had been fixed. Previously the make of gas was only a little over 8000 feet per ton of coal carbonized; but, after they were applied, the make was increased considerably—he believed to over 10,000 feet. He attributed this entirely to the adoption of the patent dip-pipe; in other words, the removal of the seal in the hydraulic main. This caused a smile; but to what were they to attribute the extra make of gas, seeing it was exactly under the same conditions? This brought him to a remark of Mr. Hunt's, wherein he seemed to hint that the fact of doing away with the dip necessitated the use of an exhauster; but he repudiated that, because the dip-pipe was taken out of the tar or liquor in the hydraulic main, there was any necessity for the exhauster. It was only removing an impediment to the gas getting away into the gasholder, by lifting the dip-pipe from the seal in the hydraulic main. What was done by using an exhauster but releasing the pressure from the retort—the pressure which was given first by the seal in the hydraulic—on to the condensers, the scrubbers, the washers, the purifiers, the holders, and so on? The dip-pipe gave a half-inch pressure if there was a half-inch seal, and if that was removed it created no greater necessity for the adoption of an exhauster than if it was kept in a hydraulic seal. There were many present who had advocated doing away with a seal in the hydraulic main—Mr. Paterson, Mr. Newbigging, and Mr. Livesey. No doubt there were some others who decidedly objected to it; but if they came to consider the matter, it would be found that to remove the impediment to the gas getting away to the holder must be beneficial, if not in increasing the make, in preventing the deposit of carbon on the retorts.

Mr. HEPWORTH (Carlisle) said this subject was worthy of a broader basis than the bottom of a dip-pipe. On the general question of waste he spoke some time ago, but there was one point to which attention might also profitably be called, but to which Mr. Hunt had not alluded. He felt sure he had not forgotten its existence, but it was such a prevailing element of waste in many works that some special reference should be made to it. He had before him the analysis of the accounts of the Metropolitan Companies, and he noticed that the consumption of coke for fuel varied from 21 to 33 per cent., and averaged 28. Now, 28 per cent., which was the average of the Metropolitan Companies, was a much lower average than prevailed in many places. Speaking generally on the subject of waste, as borne out in the analysis he had before him, he might say there could be no more profitable occupation of leisure time than for some present to go through these figures and compare them with their own working. He was sure they would find abundant room for checking and preventing waste, which was going on in their own establishments.

Mr. WOODALL (Leeds), referring to the statement of Mr. Chandler that where a patent dip-pipe was introduced the yield rose from 8000 to 10,000 feet of gas per ton of coal, though no exhauster was used, said a dip did not necessarily involve a greater pressure than half an inch. But the gasholder could hardly be supposed to show a smaller pressure than 2½ inches; so that the weight of the gasholder would be five times that of the dip, as represented in the retort. Now, if one gained 2000 feet per ton by the removal of the half-inch pressure of the dip, clearly by the removal of the weight of the gasholder, one would get a great deal more. This was a plain case, because, if an exhauster were used, the pressure must be equal throughout the apparatus.

Mr. MEAD (Sutton) feared Mr. Chandler had attempted to make out too good a case. He also had visited some Surrey gas-works, and in one case found 18 inches of pressure against the retort; and possibly others present might remember works where there was something like that. In works he had to deal with he endeavoured to remove the whole dip and let the gas pass freely through, and the difference was from 300 to 400 feet per ton of coal carbonized.

Mr. METHVEN (London) said a previous speaker had referred to figures in Mr. Field's analysis of the London Companies accounts as to the quantity of coke used for fuel. But in comparing the per centage in Mr. Field's book, they must take into consideration also the quantity of coke per ton made, which might not come out to the per centage used for fuel. In some cases the Companies only gave credit for making 33 bushels per ton, and in others 36. That ought to be considered where they compared the consumption for fuel.

Mr. PATERSON (Cheltenham) said the mention of the exhauster reminded him of a circumstance connected with the yield of gas, or the loss of gas by the deposit of carbon in a retort, which had not been as yet mentioned—the oscillation or drawing through the dip in the hydraulic main; because with all mechanical exhausters there was a certain amount of oscillation. The gas could not be drawn away perfectly continuously from the retorts, but there was what was called a pulsation. However, in Cheltenham, they had a steam-jet exhauster in action, and there the work of exhaustion was carried on so steadily that there was no oscillation at all. The gauge on the tap was so steady that, unless some means were taken to increase the pressure or otherwise, it would appear that it was stuck. It was said that the removal of the dip did away with the loss of gas from leakage through the pores of the retort, and the destruction and deposition of carbon on the material of it. The removal of the dip, unless something else was removed, would do nothing of the kind; and in the case referred to by Mr. Chandler, another element came into calculation. It was utterly impossible that the removal of the dip of itself, although it was 5 inches, would give a difference between 8000 and 10,000 feet per ton under the same conditions as to coal, temperature, and so on. They ought not to be content with even 10,000 feet, for in their experiments they could get gas to the extent of 10,500, 11,000, and 11,500 feet per ton. It was quite clear, therefore, that the gas was in the coal, and their effort should be to get it out, and, if possible, store it up and—to carry it on further—get paid for it. The way Mr. Hunt had taken up the question and worked it out was likely to result in very great good. He did not like to give results, but since Cheltenham had been referred to, he might say that they had lately carbonized about 100 tons of coal a day. Of course, their mains were by no means puny, but from that 100 tons of

coal they had no difficulty at all, day after day, in realizing from 10,000 to 10,800 feet of gas per ton. That was a large yield of gas, and, were he not able to give another fact, he should hesitate in asserting it; and, unless they got paid for a fair quantity, he should say that there was something wrong in the estimate; but, seeing that for last year they got paid for 10,300 feet per ton, he had little hesitation in stating that they did in reality get that yield. There was not much difference in coal, provided it was of a fair quality. Then there was the question of leakage, which Mr. Hunt had carefully gone into, and he had given the preference to lead services. He (Mr. Paterson) did not know whether it was the fact or not, but, in his experience in towns where lead services were universally adopted, there the leakage was much less than where iron was used.

Mr. PEEBLES (Edinburgh) wished to allude to a point which Mr. Reid drew attention to some years ago, which might account for some portion of the gas which was not accounted for—namely, that, while all experiments on the illuminating power of gas were made at a temperature of 60°, the gas was oftentimes sold at a temperature of 30°. Mr. Reid, some time ago, drew the attention of Gas Engineers to this fact, through the medium of the JOURNAL, but he had not seen it noticed since. In hard winters there must be a great deal of gas sold at a temperature of 30°, but the illuminating power of gas was tested in the laboratory at 60°. Those who had continued the tests over three or four months must, in the result, have a discrepancy in the gas as delivered from the station-meter, which very likely might be at a high temperature compared with the meters of consumers, which were often placed in cellars and other places at a low temperature. This might, in some degree, account for the quantity lost.

Mr. HUNT, in reply, said the course the discussion had taken turned almost entirely on the use of the dip. As one gentleman had pointed out, Mr. Chandler had attempted to prove too much in estimating at 2000 feet the gain from the use of the patent dip. It seemed to him almost impossible to gain anything by it, unless an exhauster were also employed, because the pressure of the gasholders and other apparatus must inevitably be thrown on the retorts. The use of the exhauster was simply to relieve the retorts of that pressure. Mr. Hepworth had referred to the fuel account as being exceptional, in some instances. Although the title of his paper was somewhat general, it was not his intention to include in it every sort of waste in and about gas-works, or he should not have overlooked that question. He might say, however, in comparing the returns with those published by the Metropolitan Companies, that he believed, as a rule, those Companies estimated the use of their coke, and took their make to be uniformly 36 bushels per ton. As a fact, many coals produced a much larger quantity, so that, in some instances, the fuel account was put lower than it should be. Mr. H. Woodall had referred to the dip not necessarily throwing more than half an inch pressure on the retort, and certainly, if the seal were accurately adjusted at half an inch, and if the water were always maintained in the hydraulic main, it would remain so; but it must be recollected that the hydraulic main speedily became filled with tar, which was of a viscid nature, and, consequently, threw much more pressure on the retorts than was apparent. Mr. Paterson had very rightly referred to the question of what could be get out of coal by experimental works. He found by repeated experiments that the coal which produced in practice 9400 feet per ton of 16½-candle gas, could be made to produce, on an experimental scale, fully 11,000 feet of 17-candle gas. That seemed to him to be a difference which ought not to exist, and they ought, as Mr. Paterson had said, to aim at producing, on a working scale, what they were able to do in the laboratory. With reference to Mr. Peebles's observation as to temperature, he must point out that at the works the measurement was at variable temperatures. If the gas were properly condensed, it brought down the temperature nearly to that of the atmosphere at the works. He would remind Mr. Peebles that 30° was two degrees below freezing point, and if they used wet meters, that would necessitate thawing them before the gas could pass through them. It was therefore too low a temperature to take.

Mr. PEEBLES said he only mentioned 30° as an illustration.

Mr. JOHN METHVEN (London) read the following paper on

A NEW STANDARD FOR DETERMINING THE ILLUMINATING POWER OF GAS.

That the present parliamentary standard for determining the illuminating power of gas is unsatisfactory, will be disputed by few Members of this Association. If we possess a doubt as to the exact length of a yard, the capacity of a quart, or the weight of a hundredweight, it is possible to have it compared with, and corrected, if necessary, by the recognized standard; also, within the last year or two, a standard burner has been duly deposited, so that we can compare the burner supplied with our photometers. But we are not so fortunately placed with regard to our standard candle, and we are still at a loss to know what a standard candle really is, although we are tolerably well acquainted with the expressions six to a pound, and 120 grains per hour. The Legislature has deemed it sufficient, and Gas Companies have not objected to it, that the light given by a certain quantity of gas shall be compared to, and its value determined by, the light given from a certain number of sperm candles possessing the above qualifications.

It has been clearly demonstrated by Mr. Kirkham, in the able paper he read at the Institution of Civil Engineers, and the results of his and Mr. Sugg's extensive and elaborate researches were brought before the notice of this Association, in the interesting lecture given by the latter gentleman at the meeting in 1870—that the candle is a most unreliable standard, and altogether unfit for determining the illuminating power of gases.

It is now nearly ten years since these serious defects in our standard were pointed out, yet new Companies have obtained parliamentary powers, and existing Companies have been permitted to extend their plant, and all have agreed that the commodity in which they trade shall be subject to this incorrect and unfair standard. Has not the time yet arrived for Gas Managers to exert their influence in a direction which will eventually remedy this?

It is the intention of the writer of this paper, before describing what he considers to be a very good substitute for the candle, to point out some of the evils attached to the present standard, and then to direct attention to some of the methods and instruments which have lately been introduced as standards for determining the illuminating power of gas.

It is generally understood that the results of photometrical experiments are influenced by altering the positions of the wicks of the candles used, and it occurred to the writer to make some experiments with different candles, and note the effect produced by the altered position of their wicks on the delicate instrument invented by Mr. Crookes, which he has termed a Radiometer; and, as these experiments appear to possess interest, the writer has determined to introduce them to the notice of the meeting, trusting that they may prove worthy of the time their explanation will occupy.

The first set of experiments were made as follows:—The candle under examination, after being lit, was hung in a delicate balance; the radiometer was then fixed on a stand, so that the centre of its globe would be in the same horizontal line as the flame of the candle, and fixed by means of fine plumb lines exactly 6 inches away from the centre of the flame, the whole being protected from draughts and reflected light by suitable screens. The candle being balanced, the minute clock was started, and for ten minutes observations were made of the number of revolutions of the radiometer. At the end of the ten minutes the candle was extinguished and weighed, the rate of its consumption of sperm and the number of revolutions of the radiometer being noted. Each candle was tried four times, the position of the wick being altered each time. The results obtained from six different candles are marked on diagram 1,* the vertical lines representing the different consumptions of sperm in grains per hour, and the horizontal the tenths of a revolution of the radiometer. The black marks are formed to indicate the position of the wicks. It will be observed that, if there had been a regular increase of illuminating power given by the candles with an increased consumption of sperm, the marks would appear all on one horizontal line. This, however, is not the case, neither does it indicate that a candle gives more light, with its wick at right angles to the radiometer, than it does in any other position; but it proves what an irregularity there is in the amount of light emitted by this uncertain standard.

Illustration of a Sperm Candle, showing position of Centre of Flame compared with Centre of Candle.

Feeling tolerably well satisfied with the results of these experiments, the writer undertook a second series with the centre of the *candle* fixed exactly 6 inches away from the radiometer. Three times each candle was tried, with the wick in a different position each time. Diagram 2 shows the results obtained from an examination of seven different candles. Each candle will be distinguished with its wick in the different positions, and by its colour. It will be observed, in all cases, that when the wicks were turned away from the radiometer, the number of revolutions was low, compared to those in which the wicks were turned towards the instrument, and that always when the wicks were at right angles the number of revolutions was about midway between the two. This peculiarity was not observed in the first series of the experiments, because the centres of the *flames* of the candles were in that case the fixed distance from the radiometer; but in the second series the centres of the *candles* (disregarding their flames) were the fixed point, and it is interesting to observe the great effect produced on the radiometer with the wick in one case bending towards it, and in the other bending away from it. One instance marked on diagram 2—wick turned from the instrument—revolutions per grain consumed, 5·66; wick turned towards it, revolutions 7·57; showing an increase of 33 per cent. Taking all the candles marked on diagram 2, the average increase in revolutions per grain consumed amounts to 22½ per cent. The altered position of the flame of the candle each time the position of its wick was moved was hereby clearly indicated by the sensitive character of the instrument. And, it was found by careful measurement to be about three-eighths of an inch—*i.e.*, the centre of the flame (the candle being turned on a fixed centre) would describe a circle three-eighths of an inch diameter.

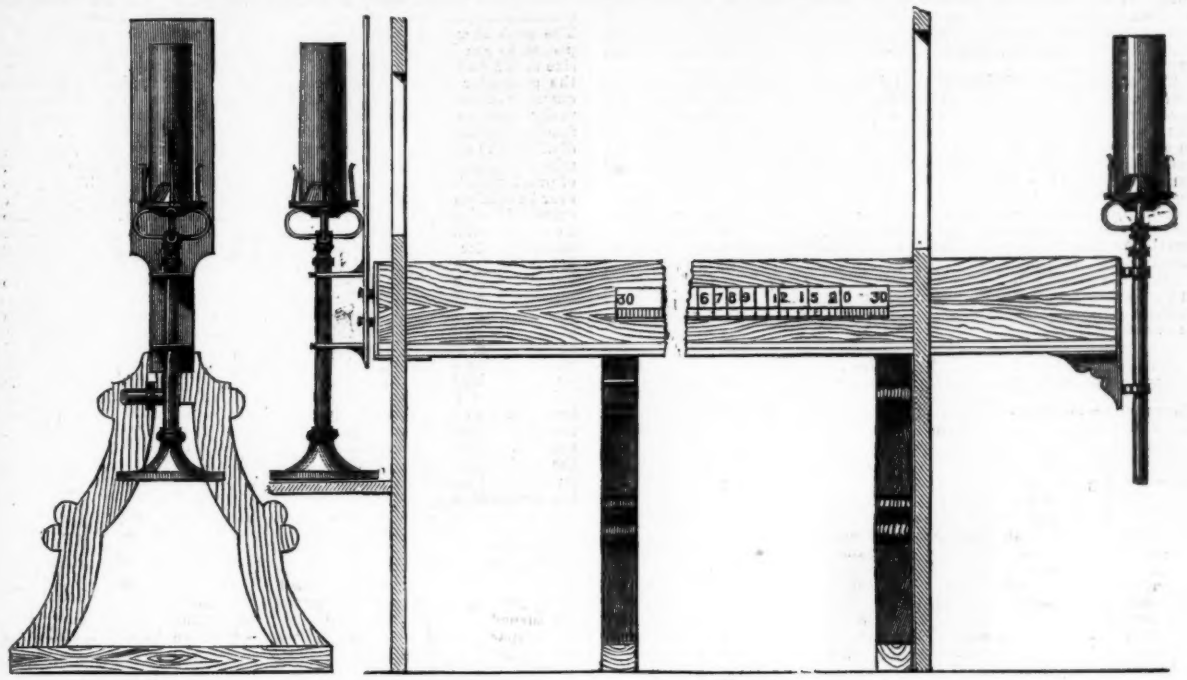
Several experiments were tried in the usual manner on the ordinary photometer, resulting in a difference in the quality of the same gas of over one candle, by using the wicks in one case turned away from the disc, and in another turned towards it; and in all cases when both wicks were at right angles to the bar of the photometer, the result was a mean of the two previous tests. A reference to diagram 2 will show the similarity between these tests and those recorded by the action of candles on the radiometer—sufficient evidence to remove all doubt as to this instrument being reliable for the purpose it was used. Heat-rays from the flames of the candles undoubtedly had their respective influences in operation, in addition to the luminous rays; yet we are able to form a fair comparison, as the whole of the experiments were made in the same way, and similar results shown.

The above results of experiments, although they are as drops compared to the ocean of facts clearly proved by Messrs. Kirkham and Sugg, tend to show, firstly, that candles do not give an uniform light, even when exactly the same weight of sperm is consumed; secondly, that there is no more light given by a candle with its wick in one position than in another, provided that the centre of the flame be the fixed point; and, thirdly, that unless (in using an ordinary photometer) the gas to be tested is compared with the centre of the flame of the candle, the resulting observations will be misleading. From this we may conclude that as there appears to be no uniform amount of light given by candles, even when of the same make and apparently exactly alike, it is an unsatisfactory standard, and that if we are compelled to continue its use, it is absolutely necessary that the *centres* of the *flames* should be in the proper position on the photometer bar. Under these conditions it is possible to improve the candle as a standard, and diminish the chance of error in its use; but as photometers are generally constructed (unless of the class recently improved by Mr. Sugg), so that the candle-holder is fixed a certain distance from the burner, it is left in the option of the operator to place his candles with the wicks in any position he chooses. The results of this latitude of discretion on the part of the operator might prove very serious to a Company who are compelled to supply a certain quality of gas under penalties. Engineers of these Companies are, therefore, compelled to make gas of such quality as to allow for the variations of the present standard; and as it is quite possible for Examiners to make the same gas vary to the extent of one candle—half a candle in favour of the Company, and half a candle against the Company—by merely altering the position of the wicks of the candles, it is necessary to make the gas, at any rate, of half a candle higher quality than there would be necessity for if the centres of the flames were the fixed point; or, in other words, if the wicks of the candles were always turned at right angles to the photometer bar.

This matter assumes a serious aspect when we look at the cost in London alone of this extra half candle. Assuming that to enrich 16-candle gas to 16½ candles costs one halfpenny per 1000 feet, and at this figure it is not over-estimated, the total quantity of gas made in London in 1876 having been 15,629,484,000 feet, it amounts to no less a sum than £32,561. That this expenditure might be considerably reduced, if not altogether saved, there is little doubt, if an uniform and unvarying standard was adopted.

The writer would suggest that so long as the candle continues to be the standard, the Referees should be required to direct the Gas Examiners to place the candles with their wicks pointing across, or at right angles to the photometer bar. But we are not all subject to have our gas tested by experienced operators, and any edict issued by the Referees would only

* It has not been found practicable to introduce this, and diagram 2, into our report.—ED. J. G. L.



END. FRONT.

affect a small proportion of gas-makers. The writer can well understand the indignation of a Gas Manager, when, just to wind up his laborious daily duties, he estimates the quality of the gas in his holder, by an experiment with his photometer, to be equal to 15 candles, he having unintentionally used the candles with their wicks leaning away from the disc, and rests satisfied with what he conscientiously believes to be the true value of his gas. When, however, his Examiner, equally anxious to act conscientiously, arrives at a very different result, the wicks of the candles he uses happening to be turned in the opposite direction, and he believing also in the satisfactory test he has made, publishes to the consumers the information that the Gas Manager has been making and delivering gas of an inferior quality. Such then is the standard that both skilled and unskilled Examiners have to operate with at the present time.

The remedy for this evil undoubtedly is to substitute an unvarying standard, and one which can be depended upon. The question still remains, How is this to be accomplished? Several suggestions have lately been made for improving the standard, among which, that of Mr. Vernon Harcourt is one of the latest. But, to the writer, the preparation of pentane gas appears to require great skill and care; great difficulty also will be found in keeping the water-line of the meter accurately adjusted, and the hight of the flame exactly defined, even with the aid of a platinum wire. These difficulties render this test unfit for ordinary practical purposes.

Next in the order of consideration (and, from its extreme simplicity, it might well have been placed first in the list) is the ingenious discovery of the radiometer by Mr. Crookes, which demonstrates the fact that light is capable of exerting mechanical power. This appears to be everything that can be desired, as far as determining the power exerted by different flames; but the delicacy of the instrument necessary to record the revolutions, as at present constructed, will probably prevent its ultimate adoption as a standard.

The illuminating power meter designed by Mr. Sugg is a very serviceable instrument, but it is considered by some to possess the same disadvantage as the pentane standard in the difficulty of regulating the height of the flame, with this important advantage, however, that the errors would be small compared with Mr. Harcourt's shorter flame in his standard.

It has also been suggested to substitute an oil lamp (as is adopted by the French for their standard) for candles; but then we have the difficulty of procuring oil of a constant quality, its liability to be affected by change of temperature, the even texture of the wick and consequent form of the flame, and the effect of atmospheric influence in its combustion.

Lowe's jet photometer, as improved by Messrs. Kirkham and Sugg, is a very useful instrument for the purpose, and recommends itself as being much more reliable than the candle.

For some time past the writer has been considering the subject of this paper, and his investigations have convinced him that it is possible to form an unvarying standard for determining the illuminating power of gas burning at one end of a photometer, by comparing it with a portion of the most luminous part of a flame of the same gas, or of gas of any other quality, consumed by a similar burner, at the other end of the photometer, in the position occupied at present by the candle. In other words, he has discovered that portions of the flames of gases of varying qualities, ranging in illuminating power between 15 and 35 candles, consumed so as to effect perfect combustion by similar burners, are equal in illuminating power.

The above engraving represents a 60-inch Letheby photometer, which illustrates the manner in which it is proposed to use the new standard. The burners used in making the various experiments, and which are considered most suitable for the purpose, are the same that the Referees have adopted as the standard burner. They are capable of consuming gas of any quality up to 40 candles with perfect combustion.

In front of the burner, between it and the photometer disc, is fixed a brass screen, with provision similar to that of an ordinary candle holder, for fixing it at the end of the photometer bar. The tube on which the burner is fixed is provided with a T-piece and union joint, to which can be attached a flexible tube from the ordinary service to the photometer, supplied with an ordinary micrometer cock and governor, to facilitate the adjustment of the height of the flame. The end of the tube is fixed on a stand, so that the whole may be lifted off the end of the bar at any time. A hole about one inch in height and one-quarter of an inch in width is cut in the screen, of the form and in the position shown on drawing, which will be found sufficient to allow an amount of light to pass through it equal in illuminating power to that given by two standard sperm candles. Screens must be provided to prevent any other reflected light acting upon the photometer disc.

After lighting the gas at both burners, and adjusting the rate of consumption of the gas to be tested, the operator will be able, by one observation, to determine its illuminating power. The size of the aperture on the brass screen might, if desired, be reduced so as to allow sufficient light to pass through, equal in power to 1 candle only, and this would appear preferable, as the scales of photometers are marked for 1 candle, but then the advantage of the more equally illuminated disc would be lost.

The manner in which the experiments were conducted, which enabled the writer to arrive at the above conclusions, were as follows:—He used an ordinary 100-inch photometer, fitted with necessary screens; a Referees standard burner at each end, connected to their respective meters and governors; and two small gasholders, one filled with common gas, equal to 15-candle power, the other with cannel gas, equal to 35-candle power. The burner on the right was supplied with common gas only; that on the left with a service from both common and cannel. The meter of the right-hand burner was adjusted to a steady consumption of common gas of 5 feet per hour. In the first place it was necessary to determine the most suitable form of aperture to be used in the screen. This was arrived at by a series of experiments representing an analysis of each flame. The left-hand burner was fitted with a tin screen, with a large hole in it, about 3½ inches high and 1½ inches wide, and a smaller screen with an aperture about 1¼ inches wide, and 3-10ths of an inch high, made so as to be easily moved in a vertical direction, and sufficiently deep to cover the large hole in the first screen. This enabled the writer to ascertain the amount of light given from the same portion of the flame of each gas. The plate on which this screen moved was marked 3 inches from the top of the burner, and carefully divided into ten spaces, each space corresponding in depth to the aperture in the moveable screen. Five observations were made, and the average recorded with the screen in each of the positions, common and cannel gas being alternately burnt in the burner behind the screen.

The tables appended to the paper show the results.

Referring to the average of the four sets of experiments in Table I., it will be seen that the position of the greatest amount of illuminating power of the flame of cannel gas is lower down the screen, or flame, than that from common gas—*i.e.*, No. 6 of common appears to be equal to No. 5 of cannel. Combustion appears to take place nearer the burner in the case of the latter than in the former. Taking three sections of each flame, 5, 6, and 7 of common, and 4, 5, and 6 of cannel, there is a very slight difference in the average of each. It, therefore, occurred to the writer that, if the aperture embraced portions of three of these horizontal spaces, it would be the best form of screen to adopt, and so it has proved itself to be. The results shown on Table I. were arrived at by using an aperture which embraced the whole width of the flame, and the variations in the results indicated are produced by two causes—first, the alterations of the width of the flame; and, secondly, the bright portion of flame which is easily observed at the edge of the flame from an ordinary Argand burner. The adoption of the vertical aperture excludes these causes of variation, and the results arrived at are quite satisfactory. It is possible to fix the screen with the vertical aperture, so that the same amount of illuminating power of flame will pass through it from both gases. Out of the whole number of long experiments the writer made—three of which are recorded on Table II.—their averages did not vary more than 2-10ths of a candle, between the power of the light through the screen with common and cannel gas, and in many cases the averages of ten observations of the one were equal to that of the other—clearly proving that a portion of the flame of 15-candle gas was equal in illuminating power to a corresponding portion of the flame of 35-candle gas.

In the last-mentioned experiments, the range of 20 candles between the quality of the two gases is so great that even if a slight variation was found between the two, it would be proportionately diminished if the quality of the two gases were nearer alike; but as it was the wish of the writer to thoroughly convince himself of the adaptability of the standard he suggests, before bringing it under the notice of the Association, he was particularly anxious to submit it to the most severe trials, and as the results which have been arrived at, and referred to above, appear so satisfactory, he has the greatest confidence in introducing the subject to the notice of the meeting as an unvarying standard for determining the illuminating power of gas. It possesses this advantage—that the quality of the gas to be tested may be arrived at by one single observation, thereby saving time. It is not dependent upon the height of the flame being accurately adjusted. The colour of the two flames being alike, the illu-

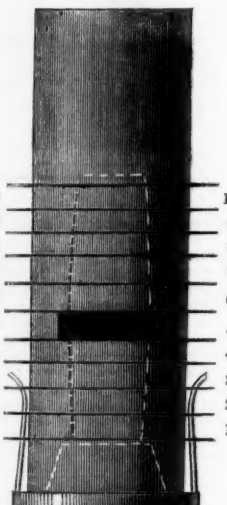
mination of both sides of the disc will be nearer alike. It is not sensibly affected by atmospheric influences. It can be used by skilled and unskilled operators without the chance of error, or of the photometer being converted into a misleading instrument, which now it unfortunately is often made to appear.

The writer's acknowledgments are due to Mr. Sugg for his kindness in constructing an apparatus, and fitting the same to one of his most recently improved photometers; also for his trouble in exhibiting his illuminating power meter, and improved jet photometer, all of which are in operation for the inspection of members. Also to Mr. Kirkham for the loan of his large diagrams, which are hung on the walls for the purpose of reminding every one concerned as to what has been done in years gone by in the matter of exposing the ridiculous standard we are at present using. And, lastly, the writer's thanks are due to the meeting for the kind attention he has received. In conclusion, he trusts he has succeeded in convincing the members that the test suggested is genuine; but if he has ailed in this, he will be quite satisfied if any remarks he has made concerning the present unsatisfactory standard have the effect of assisting in the establishment of some other standard worthy of its name. If, however, he fails in this, he will truly and feelingly say, "*Le jeu ne vaut pas la chandelle.*"

TABLE I.

Experiments to determine the Form of Aperture to be adopted.

Common Gas = 15 Candles.		Cannel Gas = 35 Candles.	
10·50		12·00	
11·15		10·53	
11·15		11·38	
12·00	8	12·00	7
4)44·80		4)45·91	
11·20		11·48	
6·50		6·80	
4·85		5·94	
6·12		5·95	
6·10	7	6·50	6
4)23·57		4)25·19	
5·89		6·29	
4·65		4·55	
4·11		4·09	
4·25		4·25	
4·65	6	4·50	5
4)17·66		4)17·39	
4·41		4·34	
4·10		3·55	
3·58		3·32	
3·82		3·32	
4·05	5	3·55	4
4)15·55		4)13·74	
3·88		3·43	
4·70		6·30	
5·34		5·67	
4·56		5·78	
5·14	4	6·45	3
4)19·14		4)24·20	
4·93		6·05	
3·88		3·43	
4·41		4·34	
5·89	5	6·29	4
14·18	6	14·06	5
4·73	7	4·69	6



HORIZONTAL APERTURE IN SCREEN EMBRACING WHOLE WIDTH OF THE FLAME.

Four series of experiments, each being the average of five observations.

TABLE II.

Result of Experiments with Vertical Aperture in Screen.

Cannel.	Common.	Cannel.	Common.	Cannel.	Common.
6·70	7·25	7·10	6·85	—	—
6·80	6·85	6·85	7·10	—	—
7·00	6·60	6·90	6·95	—	—
7·20	6·85	7·00	7·15	—	—
6·80	7·05	6·90	7·35	8·80	9·00
7·10	7·30	7·20	7·50	9·10	8·55
6·70	6·90	7·20	7·40	9·00	8·80
7·00	6·85	7·15	6·95	8·85	8·70
7·15	7·10	6·90	7·10	8·90	8·55
7·25	7·00	7·10	7·15	8·90	8·70
69·70	69·95	70·30	71·50	53·55	52·30
Aver. 6·97	6·99	Aver. 7·03	7·15	Aver. 8·92	8·72

Flame of each gas in screen burner adjusted to a height of 3 inches.
Gas at opposite end of photometer burning 5 feet per hour in all cases.

The PRESIDENT said as Mr. Vernon Harcourt was present he would ask him to describe his apparatus.

Mr. VERNON HARCOURT said: Not having expected to be asked to describe the standard I propose, I have not had an opportunity of placing it before the eyes of Gas Managers. Naturally, I do not myself think that the apparatus I have proposed is complicated to the degree to which Mr. Methven seems to think it, and I will endeavour, if I can, without having the apparatus before me, to describe it sufficiently for those present to understand. I prepare, in the first instance, a gas of constant composition. It is very readily made, for it is a mixture of air, whose composition is constant, with the vapour of a hydrocarbon which can be readily obtained from a few rectifications of the petroleum now largely sold for the production of air gas. It is of constant chemical composition, constant specific gravity, and nearly constant boiling point. The preparation consists in bringing first into an experimental gasholder a measure of air. The gasholder is furnished with a scale by which the quantity of air passed in can be read off. The one I have been employing is of such a size that I find 3 cubic feet to be a convenient quantity. In the crown of the gasholder there is a tap through which I pour in, from a measure, a quantity of pentane, which is the hydrocarbon I use. This substance is really more easily obtained definitely than either alcohol or other more familiar substances. That is simply a question of experiment. I have distilled the substance on a tolerably large scale several times, and determined the specific gravity for the products, and although there is no way of proving such a fact—one can merely state it—there is no difficulty whatever in obtaining by the gallon this liquid of uniform composition. It is extremely volatile, so much so that when a small measure of it is brought into 3 cubic feet of air, it volatilizes immediately, and forms a gas which is permanent under the greatest atmospheric pressure, and at a temperature below the freezing point of water. Thus I make a gas which consists of nearly 1 cubic foot of hydrocarbon vapour and 3 feet of air. The two conditions necessary for a photometric standard are—first, the production of a combustible, of constant composition, to give the light; next, conditions of burning which are definable and easily reproducible. The conditions of burning I propose are that the gas shall be burnt at the end of a piece of brass tubing, 1 inch in diameter, and 4 inches in length, closed by a plug half an inch in thickness, and perforated by a quarter-inch hole. I take this with a view to have simple measurements, all on a large scale, so that there is no part of the burner which, with moderate trouble, cannot be reproduced in one case exactly as it stands in another. That all quantities to be adjusted shall be sufficiently large that the errors occurring in making shall be immaterial, appears to me to be an essential condition of success. With this burner I burn the gas in the proportions I have described. The proportion between the air and gas so described is such that, when burnt at the rate of half a cubic foot per hour, the light given shall be equal to the light of an average standard candle. I check the quality of the gas I prepare by measuring the height of the gas. I fix a piece of platinum wire immediately above the orifice of the burner at a height of $2\frac{7}{8}$ of an inch. It is perfectly easy to ascertain whether the flame that is being produced is the right flame or not, and if it is, when the gas is burnt at the rate of half a cubic foot per hour, the top of the flame will precisely touch the wire. If the gas is too poor for the flame to touch the wire, it will have to burn at a greater rate; if too rich, at a lower rate. I have made a number of observations in order to choose this flame, so that it shall correspond with the average flame of a candle. I entirely agree with the remarks Mr. Methven has made as to the inaccuracy of the present standard. I have worked with it a great deal, making candle testings for a great many years, and nothing can be more unsatisfactory than the endeavour to obtain accurate results in a quantitative operation in which the standard that is used varies so extremely as, I believe, with all possible care, the standard sperm candle does vary. Mr. Methven has dealt with a particular source of error—a grave source, I have no doubt, and one which it is fair to mention was pointed out in the JOURNAL OF GAS LIGHTING, some years ago, by Mr. Young, that, when the candle bends over, as it does always, it throws the flame a little out of axis. This, I think, fairly might be remedied, in the case of two candles, by arranging the wicks so that they may look opposite ways as the candles burn down. If they are rightly placed, the movements of the two will correspond to one another, so that the mean position will be about alike. There are other more grave errors to which candles are liable. One is the difference in amount of light, given according as the cup of the candle is filled with melted grease, or is drained dry. This difference is produced by so slight a cause as opening a door or a very slight draught, and it does not pass off at once, but continues for ten minutes. The candle may be burning brightly or low, and, as the cup is full or empty, you find the difference of light, which is by no means fully compensated for by the customary allowance for the difference in the amount of sperm burnt. Another difference, still more difficult to deal with, is the accumulation of ash at the top of the wick when the candle has been burning in still air for some time. However well the wick is made, there is a considerable accumulation of ash at the end of the wick, which greatly reduces the light of the candle. A slight shock to the candle, or a slight draught, may cause this bunch of ash to fall off, with a sudden improvement in the light, so that I have found, in making experiments with the apparatus, that the removal of this, after making a set of observations, would cause a variation, in the apparent illuminating power of the gas tested, of two candles. The matter has really been made out to the satisfaction of all who have had to do with it, and the question which has to be solved, if possible, is to provide some substitute for the candle. It seems to me that a candle has this advantage; it is a familiar and tolerably intelligible one. It gives some kind of rough notion of what is meant by the illuminating power of a lamp, if we say it is equal to that of 16 or 10 candles. But I do not think that will be at all sacrificed by the substitution of another true unit of light in the operation of photometry. Just as we still retain such terms as a foot or a grain as measures of length or weight, although we no longer use a foot as an actual measure, or a grain as an actual weight, so I think 16 candles may fairly remain as a description of a particular kind of gas. I am afraid I am scarcely able to offer any criticisms as to what Mr. Methven has brought before you, seeing the apparatus for the first time. I remember, when Mr. Sugg gave an account of his illuminating power meter before the Institution of Civil Engineers, he made then these statements:—That however the quality of gas that was being burnt varied, if the flame were kept about the same, the actual light given was the same; that gas-flames burnt with a particular burner varied not in brightness but in size; and that the actual amount of light given per unit of light is the same, whatever the quality of gas burnt. I understand Mr. Methven chooses a hole of a particular form and at a particular distance from the burner to exclude all but the least portion of this tolerably uniform light, and that this portion of light passing through the screen may correspond to the light of two candles. As I have said, it is difficult, if not impossible, without having experimented with such an apparatus, to form for oneself any judgment as to the degree of accuracy obtainable with it, and I would only ask that Mr. Methven, having been in the same case as I have with regard to his apparatus, and not having had an opportunity of making any comparison, will be equally willing as I am to reserve his judgment in the matter.

Mr. GEORGE LIVESEY said that, having used Mr. Harcourt's method for a considerable time, he could corroborate what had been said, and had found no difficulty whatever in the management of it. The question of getting the proper height of the flame was not a difficult one in any sense whatever. There was just the simple flame, and he believed it was a means of testing infinitely superior to the candle. He was not going to say that Mr. Methven's might not be better, and if, by other experiments, it was proved that that simple apparatus, with a slit in the intercepting plate, could be depended upon to give a uniform quantity of light under all circumstances, it seemed an exceedingly simple arrangement, and one which could be applied anywhere and everywhere. Whether they could get the public to believe that they were receiving a proper quality of gas,

when the standard by which it was tested was the gas which was being tested, he was not quite so certain. He feared the public would be apt to say that it was so managed as to "do" them in some way or other.

Mr. WARNER (South Shields) said there could not be two opinions as to the interesting nature of this discussion, and the paper had come in very opportunely with Mr. Harcourt's description of his apparatus. One question he wished to ask was, In what manner did this process of Mr. Methven's differ from the principles set up by Mr. Fiddes some years ago? He remembered visiting his works at Bristol some time afterwards, when he gave him an interesting account of the work he had been doing, and he wished that gentleman were present, as he might throw a little light on the subject.

Mr. HARTLEY (London) said he hardly dared venture to say a word in favour of candles, which seemed to have gone completely out of favour of late, although there were still some users who considered a candle to be an exceedingly good standard. There was one difficulty in the adoption of a new standard—that the Acts of Parliament would have to be modified before any other standard could take possession of the field. With Mr. Harcourt's test he was perfectly familiar, and he must acknowledge there was no difficulty in using it. He had prepared the gas, and could assert that it could be used with facility. In the paper just read he found reproduced a scheme with which he was familiar some years ago, and with which he worked for a considerable time—that of Mr. Fiddes. Unfortunately, he could not obtain with that arrangement the same result which Mr. Methven said he had obtained. He found that unless he maintained the flame at a very constant height, and if, moreover, he had variations in the quantity of gas, there were variations in the indication given by the instrument, and, therefore, that he could have no standard, and could put no dependence, in fact, in the indications given by the photometer. Mr. Methven had startled him considerably by stating that a range from something like 16 up to 35 candle gas enabled him to get the same illuminating power through the apertures he had in his opaque chimneys. He was not prepared for that, because he found, when working with Mr. Fiddes's arrangement, great divergences; and, unless the aperture was very carefully arranged, and, not only so, but the height of the flame very carefully maintained, he ran a great risk of having the luminous point raised into different positions, and, therefore, failed to get the same indications on the photometer. With regard to candles, all he could say was that the defects arose from the non-observance of the due conditions which should belong to the use of candles. If, as indicated by Mr. Young, years ago, the candles were placed at right angles, so as always to preserve their centres in due relationship to the disc, the difference would not be so extreme as Mr. Methven indicated; but if the candles were allowed to burn anyhow, one might expect to find a considerable divergence in the results. He mentioned years ago some points he thought should be regarded in the use of a candle, and certainly he had never been able to find such extreme divergences as appeared to have been noticed by others, though those differences and divergences did sometimes arise, he had no doubt. Certainly candles did vary considerably, and in asking operators to use candles, he asked that they should be burnt properly, with the wicks properly centred, and if they were not, that the candles should be rejected. The radiometer had been referred to, but that Mr. Methven did not prefer to use as a photometer, although he had obtained manifestations which were very interesting. He (Mr. Hartley) did not know whether that was ever likely to be found useful, for he had never settled how far the influence of heat operated in contradistinction to light. He should feel great pleasure some day in seeing a better standard, and if it were such a one as ought to be adopted, he had very little doubt that alterations in Acts of Parliament might be made to suit this or Mr. Harcourt's test, which he had had the pleasure of working with for some time, but he thought there would be considerable difficulty in persuading the Legislature and the public that such a change was desirable or necessary.

Mr. HISLOP (Paisley) thought that so long as candles were used, there should be some definite understanding as to the position in which the wicks were placed. He had given his views on this subject in the JOURNAL OF GAS LIGHTING—namely, that the back of one wick should be turned to the photometer-bar, and the broad side of the other, so that the exact mean of the flames at the centre should be secured. He held that if the broad side of the two candles were placed towards the bar, the true light of the candles was not obtained, as there would be more than the due proportion of light sent in two directions. One reason why he believed a considerable difference might arise in the results obtained by different experimenters was the use of funnels on the top of the photometer-boxes. Many boxes were used, closed in front, with a curtain to hang over to exclude the daylight, and it was the practice to provide them with funnels at the top. Many years ago he had one supplied to him, and could not, by any means, get the candles to burn steadily, neither in regard to the oscillation of the flames, nor the quantity of sperm consumed, until he took off the funnels. Indeed, he had to all but close the opening in the crown of the box with an iron plate, leaving only about an inch or an inch and a half uncovered, and then he obtained a perfect steadiness of flame, never exceeding a variation of half a grain in the consumption of sperm. In common with his friend Mr. Hartley, he had given a very fair trial to Mr. Fiddes's method of illuminating the bar through a $\frac{3}{8}$-inch hole in a copper tube, substituted for the ordinary glass chimney over an Argand burner. If he remembered rightly, it was placed exactly $1\frac{1}{2}$ inches from the top of the burner, and was supposed to give a light of one candle. He gave it a fair trial, but was obliged to abandon it. They were all at one, however, as to the desirability of having one standard which they could all adopt, and obtain satisfactory results from on all occasions. He hoped the new method would result in a complete success.

Mr. BALL said he had just been working for about three weeks with a photometer, and he had been working not only with candles, but with one or two other things as well. They had just been making a long series of tests, and when they got some distance through them, having tested about 25 or 30 samples with a great many variations of results, it occurred to him to change the disc in the reflector on the photometer-bar (which was a 60-inch Letheby), with the startling result of an addition of two candles to the illuminating power. This was a matter which could scarcely be overlooked when it affected some parties to a serious extent, and it necessitated commencing the experiments all over again. In addition to this defect, he found, as Mr. Harcourt had said, that if any interruption occurred during the observation, such as the opening of the door into the room, it materially affected the illuminating power of the candles for perhaps two or three minutes, so much so as to necessitate a fresh observation altogether, and particularly if it should happen to occur towards the end of the test, when the consumption of sperm could not possibly make up for the difference in the illuminating power. It would be sometimes equal to one and a half or two candles. He should be very glad if Mr. Methven's system should prove a success, because it would materially reduce their labours once a year, at all events, if they could take one test, instead of having to take 10, 20, or 30.

Mr. PEEBLES (Edinburgh) was glad Mr. Methven had taken up the radiometer, which he thought had not received the attention it should have had from gas analysts. If he mistook not, Mr. Goodwin, of Philadelphia, made some experiments in connection with the radiometer, and gave the results at one of the meetings of the American Association. He was Major Dresser, the Editor of the *American Gaslight Journal*, present, and perhaps he could state what those results were. He might say that, as the Association talked about visiting Scotland, they might possibly, in a year or two, hold a meeting in America, and, if they did so, he was sure there would be no one more willing or anxious to extend the hospitality of the New World to them than Major Dresser. At any rate, he could speak in the warmest terms of the kindness with which he and one or two friends had been received in America.

Major DRESSER said he had had a long connection with the gas business, but his duties were more to make public what other men did than to give any facts with reference to what had been done by himself. After thanking Mr. Peebles for the kind manner in which he had referred to the small amount of attention which had been paid to them, he said he would second most heartily the suggestion thrown out by that gentleman, and if the Association would go to America, he was sure they would have such a reception as only the gas makers of England were entitled to from the gas makers of America. With reference to the experiments of Mr. Goodwin, they were given at a meeting of the American Association at Cincinnati. He simply found that, taking gas of a known illuminating power as previously determined, the motion of the radiometer did vary with the different illuminating powers of the gas. He did not think the matter had been fully investigated, and merely indicated that as a line which might be pursued with interest by those who desired that most desirable of all things, a fixed standard for illuminating power. They were blest in America with very little in the way of examination, and as long as they could say that the candles they used were candles imported from England, that they were standard candles and must be right, the ordinary alderman succumbed. He should be very glad if he could go back and say to his fellow-countrymen, who watched their brethren in England more closely than they had any idea of, that they had found something which was an absolute standard.

Mr. METHVEN, at the close of the discussion, said that the only question he had really to answer was that of Mr. Warner, who asked whether this method was similar in idea to that of Mr. Fiddes. Until he was informed of the nature of this experiment by Mr. Hislop, he was not in a position to say; but from what he gathered, Mr. Fiddes's idea was to take a portion of the flame, to cut a hole in the brass screen which surrounded the flame, to allow that portion of the flame to act on the photometer disc, without any regard to the steadiness of consumption of the flame, or anything else. If that were so, there was no difficulty in seeing why it did not answer. The screen he adopted was immediately in front of the burner, burning with a steady flame inside a chimney. He could only refer to Mr. Sugg's illuminating power meter, which, as Mr. Harcourt said, resembled his in principle. It purported to record the illuminating powers of different gases varying in quality, simply by regulating the height of the flame burning through the same burner. Although he did not take his idea exactly from the illuminating power meter, it was the same principle. The facts he had stated were correct, and he should be pleased indeed if any one sufficiently interested in the matter would come to his works, where he would explain the process more fully. He need only add that he was not personally interested in the matter at all, and brought it forward thinking that it would be interesting, knowing that a new standard was much required.

(To be continued.)

SOCIÉTÉ TECHNIQUE DE L'INDUSTRIE DU GAZ EN FRANCE.

[Translated from the *Journal des Usines à Gaz.*]

The Ordinary General Meeting of the above Society was held on Monday, June 24, in the Hall of the Society of Civil Engineers, 10, Cité Rougement, Paris, under the presidency of M. SERVIER, the President of the Society.

The sitting opened at nine o'clock a.m., and there were present MM. Mallet, Vautier, and Eugène Lebon, Past Presidents; MM. Ellissen and Leclerc, Secretaries; M. Foucart, Treasurer; MM. Backler, Da Costa, Monnier, Vacher, and Vée, Members of the Committee; and a good assemblage of the Ordinary Members and Associates of the Society.

The minutes of the last general meeting having been read and adopted, the meeting proceeded to the election of the new Members who had been provisionally admitted by the Committee.

The PRESIDENT then read the following report of the operations of the Society for the past year:—

"I have the honour of presenting to you, in the name of the Committee, who have been good enough to call upon me to preside over them during the current year, a summary of our labours, leaving to the Treasurer the duty of enlightening you upon the financial position of our Society.

"We present for your approval the admission of 33 new Ordinary Members and nine Associates, which will bring the number of Members admitted up to the present time to 279. This number is still far from what we ought to attain, and we invite each one of you to exert his influence and personal relations in order to bring in additional recruits.

"We have not considered it advisable, after this year, to renew the negotiations with the view of getting our Society recognized as an establishment of public utility, its youth having been the only reason which induced the Counseil d'Etat to defer pronouncing a favourable opinion. This defect will disappear each year, and we have other reasons to bring forward in order to obtain the desired result. Several Members of our Committee have been called upon to act on the Juries for the admission and installation of exhibits at the Exposition Universelle, and are actually members of the Jury of Awards. Unfortunately, the great labour necessitated by these duties deprives us for the moment of the assistance of M. Jordan, whose resignation of the Vice-Presidency of your Committee we have very reluctantly been compelled to accept—a resignation induced at once by his state of health and by his multifarious occupations.

"We have also lost the assistance, as Secretary of the Committee, of M. Brémond, who has been called away to take the management of the gas-works at Madrid, and whose zeal and devotion to the interests of our Society you have been able to appreciate. M. Brémond has been replaced by M. Leclerc, and your Committee have every day cause to congratulate themselves upon their choice.

"The financial position of the Society enables us to rent, at No. 9, Rue de Provence, premises which, if not sufficiently spacious for our annual meetings, are at least large enough to allow of the Committee meeting there, without abusing the kind hospitality of M. Eugène Lebon, and of the fitting up of a reading-room for the Members of the Society. The library is in the course of formation, thanks to the liberality of several Members, whose example certainly cannot fail to be followed. We give the titles of the works presented and the names of their donors, to whom we publicly offer the thanks of the Society, as well as to those Members who have kindly participated in the furnishing of the premises.

"Translation of Clegg's Treatise on Gas Lighting," presented by M. Servier.

"Treatise on the Pressure of Illuminating Gas," presented by M. Giroud.

"Ready Reckoner for Calculating the Size of Gas Service-Pipes," presented by M. Monnier.
"On the Correct Measurement of Gas," pamphlet presented by M. Rouget.
Two Designs of Settings of Seven Retorts, by M. Motet.
Manuals presented by M. Magnier—
"On Lighting and Heating by Gas."
"The Mason, Slater, Pavior, and Tiler."
"The Lime-burner, Plasterer, and Quarryman."
"On the Manufacture of Mineral Oils."
"Technical Tables applicable to the Gas Industry."
Collection of Note-books for Gas-Works by M. Durand, presented by M. Bablon—
"Collection of Jurisprudence."
"Questions submitted to the Conseil d'État."
"Special Legislation."
"Gas-Meters."
"Regulating the Quality of Gas."
"The Accounts of Gas-Works."
"The Lighting of Public Thoroughfares."

"We shall ask you to authorize the expenditure of a certain sum in the purchase of other works of interest in our industry. A record keeper is attached to our Society, and attends every day from one till four o'clock, to receive those Members who may desire to consult the works.

"The Society has been allowed to exhibit, in the Technological Library at the Exhibition, a collection of the reports of its meetings.

"The gas companies and proprietors of gas-works who contributed to the funds of the Society in the year 1877 have renewed their contributions for the current year, and in the name of the Members of the Society we tender them our sincere thanks. The total amount of these contributions reaches 9055 frs. (£362), apportioned as follows:—

	Francs.
M. Vautier, of Lyons, for the 21 works under his direction	2225
The Paris Gas Company	2000
M. Eugène Lebon, for the Central Gas Company	1200
The Lyons Gas Company	1000
The European Gas Company	750
The Gas Company of La Guillotière	500
The Madrid Gas Company	250
M. Foucart, for his works at Laon and Vervins	100
M. Servier, for his works at Avesnes and Longwy	100
MM. Foucart and Servier for their works at Poissy	50
The Mulhouse Gas Company	100
M. Hugon, for the General Gas Company of Paris	250
M. Bioche, for the Elbeuf Gas Company	100
The French Gas Company of Amiens	150
M. Beglet, for his works at Corbeil	100
M. Rouget, for his works at Brest	80
The Maubeuge Gas Company	50
M. Heudebert, for the works at Louviers	50
Total	9055

"We have just received a valuable token of sympathy from the British Association of Gas Managers, who, on the proposition of the Committee, have at their general meeting unanimously elected as honorary members of that Association your present and past Presidents. We appreciate at its true value the honour thus paid to us, and we propose to you to elect as honorary members of our Society, Mr. Corbet Woodall, Acting President of the British Association of Gas Managers, and Messrs. Thomas Hawksley, Ebenezer Goddard, Alexander Angus Croll, George Livesey, James Paterson, Robert Morton, and Robert Paulson Spice, Past-Presidents.

"The ties which will unite us to the British Association, our senior, cannot fail to contribute to the development of our Society, by the exchange of ideas and the cordiality of relations, which we shall seal this evening at the banquet at which we are to meet.

"We have reason to hope that the communications to be made this year will present a certain interest. We nevertheless regret that the questions put forward for competition have not inspired a greater number of competitors. It is true that these questions necessitated considerable labour, to which many of you are only able to devote a limited amount of time. We propose to you to again vote a sum of 5000 frs., which will be carefully divided by the Committee among several prizes to be put up for competition.

"On the other hand, the prize of 200 frs., allotted to the most meritorious foreman or workman, has been striven for by a great number of competitors, all worthy of sharing it in many respects. We have thought that the financial position of the Society would permit of the allotment of three equal prizes, and we shall propose to you to leave the competition open for next year.

"We have concluded this rapid exposition of the subjects which interest your Society. It remains for us to inform you that, according to the rules, the powers of four Members of the Committee expire this year; they are, MM. Brémond, Leclerc, De Loriol, and Vacher. These are eligible, and offer themselves to you for re-election. We propose that you should re-elect them for three years.

"The present President becoming by right a Member of the Committee, it will be necessary to elect a new Member for two years."

If the meeting have no observations to make on the matters I have had the honour of bringing before them, the Treasurer will read the report of the Committee on the Society's finances and the accounts for the past year.

The Treasurer then read the financial report.

M. Ellissen read the report on the papers presented for the prize competition for 1878. Conformably to the conclusions of this report, the meeting decided that no reason existed for distributing the prizes offered for this year, and voted the sum of 5000. frs for the prizes to be distributed in 1879, charging the Committee with the duty of determining the conditions of competition.

The President invited the Members to inform the Committee what subjects they would like to see offered for competition, in order that the Committee might choose those that would interest the greatest number.

M. Leclerc read the report on the prize allotted to the foreman or workman who had performed the longest service and discharged his duties most creditably in any gas-works. Conformably to the conclusions of this report, the meeting decided unanimously that three prizes of 200 frs. should be awarded, as follows:—To Mr. James Seabrook, gas-works, Amiens; to M. Voric, gas-works, Louviers; and to M. Pauline, gas-works, Metz.

M. Desperrieres proposed to increase the honorary value of these prizes by adding a diploma which should remain as a *souvenir* in the hands of those who had been judged worthy of the rewards. This proposition was agreed to.

In conformity with the proposition made, the meeting unanimously elected, as Honorary Members of the Society, the present and past Presidents of the British Association of Gas Managers.

The meeting then proceeded to nominate five Members of the Committee to replace MM. Brémond, Leclerc, De Loriol, and Vacher, whose term of office expires this year, and M. Servier, the retiring President, who becomes by right a Member of the Committee.

The President remarked that the retiring Members were eligible for re-election, and offered themselves to their colleagues accordingly.

On being put to the vote, MM. Vacher, De Loriol, Leclerc, and Brémond were re-elected, and M. Marché was likewise elected, the term of office being three years.

The sitting closed at eleven o'clock.

Visit to the Works at La Villette and Ivry.

On leaving the meeting of the Société Technique, several members proceeded to the Paris Gas Company's station at La Villette, where they were very cordially received, and conducted over the works, by M. Arson, Engineer-in-chief, and the principal officers of the Company, accompanied by M. Cury, the Superintendent of the station.

In the afternoon the members of the Société Technique and of the British Association of Gas Managers paid a visit to the works at Ivry, where they were received by M. Arson and the Engineers and Superintendents of the Paris Gas Company. Previous to making an inspection of the works, the party partook of luncheon, kindly provided by the Company, in one of the retort-houses, which had been prettily decorated for the occasion with foliage and the French and English flags. There was also on view a very fine collection of drawings, products of coal, minerals, &c.

M. Arson expressed to the visitors the regret experienced by the Directors of the Company at being unable to be present at this gathering; and Mr. Woodall, in the name of the British Association, and M. Servier, on behalf of the Société Technique, thanked M. Arson, begging him to transmit to the Directors of the Company the expression of their gratitude for the magnificent reception accorded to the members of their respective societies.

Banquet.

In the evening, at seven o'clock, a banquet took place under a tent erected for the occasion on the island of the Great Lake in the Bois de Boulogne. The Members of the Société Technique then in Paris, and a considerable number of the Members of the British Association of Gas Managers, were present, as well as a few guests, among whom were the Members of the Committee of the British Association; the Engineers and Superintendents of the Paris Gas Company; Major Dresser, the Editor of the *American Gaslight Journal*; and Mr. Greenhalgh, the Superintendent of the Boston Gas-Works. The company numbered 218.

The banquet opened with a performance of "God Save the Queen" by an orchestra under the direction of M. Desgranges, all the company rising to do honour to the English National Anthem.

On dessert being brought on, M. Servier, the Chairman, rose to propose the following toast:—Gentlemen, The general meeting of the Société Technique, which took place this morning, unanimously, and by acclamation, awarded the title of honorary members to the Acting and Past Presidents of the British Association of Gas Managers. That Association has done a similar honour to the Acting and Past Presidents of the Société Technique. This fact appears to me to have a far greater signification than a simple exchange of courtesies between two societies. In my opinion, it is the manifestation of a sentiment which seems to animate at the present moment the majority of civilized peoples. This sentiment is that of peace, concord, and work. For myself, I experience a patriotic contentment, which you will easily understand when you consider that hardly eight years ago I was blockaded in the city of Metz, and saw my country dismembered, and my native city a prey to the incendiary, and that to-day, thanks to the kindness of my colleagues, I have the honour of presiding over a gathering altogether peaceful and fraternal in that same city, which is justly proud of the success of her Universal Exhibition. We do not forget, gentlemen, that this success is due, in a great measure, to the sympathy of foreign nations, and more particularly England, which is so well represented in our midst by the Members of the British Association of Gas Managers. I therefore propose this toast—"To the friendly nations, to Her Majesty the Queen of England, and to the English people, whose friendly visit we this day celebrate."

The orchestra again played the English National Anthem, the entire company standing.

Mr. Woodall, President of the British Association, responded in English, and proposed "The President of the Republic, the French nation, and the Société Technique." One passage in his speech, which was specially noticed, alluded to the popularity enjoyed in England by H.R.H. the Prince of Wales—a popularity due, in a great measure, said Mr. Woodall, to the attachment felt by the Prince towards France.

Mr. Backler, a member of the Committee of the Société Technique, kindly translated into English and French the toasts proposed by M. Servier and Mr. Woodall, and the orchestra performed the "Marseillaise."

Other toasts were proposed by M. Deroy, Director of the Gas-Works at La Fère, "To the Founders of the Société Technique;" by M. Des Gouttes, Engineer of the Geneva Gas-Works, who said that the little Swiss Republic saluted the great French Republic; by Mr. Backler, "To the Prosperity of the two Societies," of which he considered himself to be the connecting link; and by MM. Eugène Lebon, Arson, and Gigot. All these toasts were received with great applause by the company generally, and were greeted with cheers from the English visitors.

M. Desgranges's orchestra enlivened the remainder of the evening till ten o'clock, when the company separated. Every one present will retain a pleasant recollection of this gathering, which was favoured with splendid weather, and the meeting will leave its mark in the annals of the Société Technique.

List of Communications Read.

Tuesday, June 25—*Morning Sitting.*

"On the Employment of Waste Heat for the Heating of Steam Boilers," by M. De la Chomette.
"Description of a Process for Finding and Measuring Escapes of Gas," by M. Mallet, jun.
"India-Rubber Joints for Mains," by M. De la Chomette.
"Constant Level Meter," by MM. Siry and Lizars.
"On the Revivification of Oxide of Iron Purifying Material in the Purifiers themselves," by M. Servier.
"Construction of Purifiers in Masonry," by M. De la Chomette.

Afternoon Sitting.

"Heating of Ovens by Gaseous Combustibles," by M. Monnier.
"Description of a Gasholder-Tank constructed of Wood," by M. Kroos.
"State Management of Municipal Gas-Works," by M. Bresson.
"Autodynamic Safety-Valve," by M. De Craponne.
"Observations on the Decree of Feb. 9, 1867, relative to Gas-Works," by M. Leclerc.

Wednesday, June 26—*Morning Sitting.*

"New Process for the Automatic Lighting and Extinguishing of Gas-Burners" (M. Clément's invention), by M. Servier.

"Moveable Joint for Gas-Mains," "Rotatory Condenser," and "Constant Level Meter," by M. Bresson.
"Taps with movable Seats and Cylindro-conic plugs," by M. Chapa.
"New Method for the Revivification of Purifying Materials," by M. Des Gouttes.
"The Economical Repair of Cracked Chimneys without the Aid of Scaffolding," by M. Des Perrières.
"The Economic Manufacture of Compressed Fuel," by M. Des Perrières.
"M. Paupert's New Process for the Manufacture of Sulphate of Ammonia," by M. Foucart.
"Durand and Chapitel's Coke-Crusher," by M. Foucart.
"New Gas-Exhauster for Small Works," by M. Girardet.
"Note upon Policy Stamps," by M. Leclerc.
"On Removing Obstructions from Ascension-Pipes," by M. Rouget.
"Infinitesimal Pressure Balance or Manometer," by M. Servier.

COMMUNICATIONS NOT READ.

"Apparatus for Washing and Purifying Gas," by M. Colladon.
"Louis Giroud's Coke-Crusher," by M. Des Gouttes.
"Closing Retort-Lids without Luting," by M. Rouget.
"Apparatus for the Separation of Tar and Ammoniacal Liquor," by M. Riollé.
"On the Verification of the Illuminating Power and Value of Gas," by M. Giroud.
"On Bitumenized Wrought-Iron Main-Pipes," by M. Chameroy.
"On Regulating Levers registering Weight," by M. Chameroy.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The coal trade is without material change, so far as either prices or the amount of business doing is concerned. A few inquiries for forward contracts at present prices are reported, but colliery proprietors, although willing to take very low figures for immediate deliveries, do not, as a rule, care to sell very far forward at the current unremunerative rates. At many of the collieries, heavy stocks are held for the time of the year, and where the pits are only working to the orders which come to hand, they are not kept more than half employed.

The demand for all classes of round coal continues very small, with quotations at the pit mouth remaining at about 9s. to 10s. per ton for best Wigan Arley, 7s. 6d. to 8s. 6d. for second qualities, for house-fire purposes, 7s. 6d. to 8s., for ordinary Arley gas coal, 7s. to 7s. 6d. for Pemberton four-feet, and 5s. 6d. to 6s. for common Wigan mines for steam, forge, and gas-making purposes; but where buyers have large orders to place for prompt cash, there is no difficulty in purchasing at under the current market rates, and it is difficult to ascertain what prices in such cases are accepted. Although there is an improved inquiry for engine classes of fuel, there is no great pressure of demand, but the present restricted production, in consequence of the small quantity of round coal now being screened, causes the supplies in the market to be less plentiful, and prices are firm at late rates, good burgy selling at from 4s. 6d. to 5s. per ton at the pit mouth, and good slack at from 3s. 6d. to 4s. per ton.

The shipping demand for coal is still extremely dull, and to clear off stocks exceedingly low prices are taken.

In the iron trade there is still only a very limited amount of business doing, although the local makers of pig iron are able to clear off their present small production at about late rates. For finished iron, very few orders are reported in the market, and prices are without material change, local bars delivered into the Manchester district being offered at from £6 to £6 2s. 6d. per ton.

So far the peaceful conclusion of the Congress has had little effect upon trade here, but the resumption of a few Russian orders, which had been stopped, has made one or two of the local works rather busy.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The business done in best gas coal is equal to the usual summer average. That is, 30,000 chaldrons of coals, mostly gas, have been shipped from the Tyne Dock in each of the two weeks of July. The demand is mostly for best sorts. The bulk of the best gas is sold under contract. Best gas coals offered in the open market are disposed of, at recent quotation, from 7s. to 7s. 6d. per ton, and a medium sort is sold at about 6s. net. There has been a fair demand for gas coal for Ireland, and steamers usually employed in the London or Hamburg trade are engaged carrying gas coals to Dublin and other Irish ports. The greatest depression continues to exist amongst second and third class collieries. Steam coals are not at all strong in the market. They are quoted at from 6s. 6d. to 9s. 6d. per ton. Second-class collieries generally are not working more than half or two-thirds time.

The freight market is in a collapsed condition, and gives no symptoms of a rally. Little more than 4s. a ton is the rate paid steamers, and 5s. a ton sailing vessels, for London. Scarcely any business was transacted with the East coast last week. There have been few orders in the market for France. Hamburg rates are down to £5 and £5 10s. a keel; Rouen, 6s., Havre, 5s., and Dublin, 6s. 3d. per ton. The quotation for steamers to take coals to Cronstadt is now only £7 10s. per keel, and the home trade from the Baltic, Mediterranean, and Black Sea is very poor indeed. To all appearance the freight market will largely favour shippers and importers all through 1878, as the tonnage, especially steam, is very much in excess of any trade there is likely to be this year.

The chemical market has not upheld recent advances, small as they were; it is flat and dull again, and prices have fallen considerably. The iron trade was a little slow last week. The lead and copper trades were quiet. There have been considerable shipments of metal pipes for gas and water. The price of pig lead is £17; dry white lead, £24; red lead, £18 10s.; and litharge, £19 10s. per ton. Copper, flat cake and ingot, is quoted at from £66 to £68; best selected, £72 per ton. There have recently been somewhat better shipments of fire-clay goods and fire-bricks, mostly to the Continent, but the trade is only dull.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At the last annual meeting of the Brechin Gas Company, a very favourable report was presented by the Directors, and on their recommendation, the price of gas was reduced from 5s. to 4s. 9½d. per 1000 feet—the best gas and the cheapest, it is said, of any town of the same size in Scotland. A dividend of £1 per share was declared. Originally the shares were £5 each, but they are now being offered for sale at £25.

The Alyth Gas Company have declared a dividend of 8 per cent., and have resolved to continue the price of gas at 6s. 8d. per 1000 feet. There was a smaller consumption of gas last year than in the year previous.

A dividend of 10 per cent. to the Shareholders has been recommended by the Directors of the Crieff Gas Company out of the profits of the past year.

On the recommendation of the Directors, a dividend of 8 per cent. has been declared by the Anstruther and Cellardyke Gas Company, while the sum of £100 has been added to the reserve-fund (making it £600), and the price of gas has been reduced from 5s. 10d. to 5s. per 1000 feet, which is the lowest rate at which gas has yet been sold in Anstruther. The same dividend has been paid for upwards of 20 years.

The Shareholders of the Pittenweem Gas Company, at their last annual meeting, declared a dividend of 7 per cent. per annum for the past two years, added £40 to the reserve-fund, and resolved to reduce the price of gas from 7s. 6d. to 6s. 8d. per 1000 cubic feet.

At the annual meeting of the Coupar Angus Gas Company, held on the 4th inst., a dividend of 7½ per cent. per annum was declared, being the same as last year. Mr. Thomas Inches, who has been Manager to the Company for the long period of 23 years, feeling himself, through age, unable longer to discharge the duties of his office efficiently, resigned his situation, which was accepted.

Mr. J. Falconer King's report upon the illuminating power of the gas supplied in Edinburgh on the 26th ult. was presented to the last meeting of the Town Council of Edinburgh, and showed that the Edinburgh Company's gas stood at 26·18 candles; and that of the Leith Company at 27·20 candles. In connection with this report, Treasurer Wilson suggested that if any member of the Cleaning and Lighting Committee chanced to be in Paris, he might make inquiry as to the cost of the splendid lime light (query *electric* light) used in the Place de l'Opéra, with a view to some experiment of the kind being made in Edinburgh.

As so many of the Scotch Gas Managers have recently visited Dundee Gas-Works, it may be worth while to direct attention to the quality of Dundee gas. One of the Police Commissioners, a few days ago, said publicly that the lighting power of the gas, which used to be 26, 27, and 28 candles, had now fallen to 24 and 25 candles; but Mr. Maxwell, one of the leading Members of the Gas Commission, corrects that statement, and gives the illuminating powers of each for the last five years. The following figures show the average of all the photometer tests made:—

Average	1874	26·78 candles.
,,	1875	26·16 ,,
,,	1876	27·83 ,,
,,	1877	26·49 ,,
,,	1878	26·96 ,,

The Glasgow pig iron market was dull and drooping all last week, and the price fell on Thursday, which was the closing day, to 49s. 6d. cash, from which there was subsequently a slight improvement. There is a very marked absence of animation.

While at present the coal market is very quiet and dull, there is certainly a more hopeful tone, founded on anticipations of an improvement in business setting in, now that the Eastern difficulty approaches a settlement.

SALTCOATS GAS COMPANY.—At the annual meeting of Shareholders on the 3rd inst., a dividend of 10 per cent. on the capital stock was declared.

CONVICTION FOR WASTING WATER.—An ironfounder of Longton, named Derbyshire, was convicted before the Hanley Police Magistrate on the 1st inst., for wasting water belonging to the Water-Works Company. Mr. Cruden, for the Company, said the defendant, who only paid for a domestic supply, not only used the water to feed a boiler, but allowed large quantities to run to waste. This statement was denied, but the Magistrate considered it a case calling for a heavy penalty, and fined the defendant £5, and costs 21s. 6d.

PUBLIC LIGHTING AT TOTNES.—At the meeting of the Totnes Town Council on the 3rd inst., tenders were received for lighting the public lamps with gas, oil, or otherwise, from the 1st of August next, for three years, according to advertisements issued. There were two tenders—one from Messrs. Bailey and Son, of Poole, who were the Contractors for the past two years, and whose contract expired on the 31st of May last; the other from the Totnes Gas Company. Bailey and Sons tender for lighting with oil was £3 11s. 6d. per lamp per year; that of the Gas Company was £3 10s. 8d., conditional on the Council withdrawing the proposed penalty of 5s. per lamp per night for non-lighting, and substituting 3d. per lamp per night for the summer months, and 6d. during the winter months—the original proposition of the Lighting Committee, brought up at the last meeting of the Council, when an amendment, altering the penalty to 5s. per lamp, was substituted. It was now decided that the tender of the Gas Company be accepted, subject to the penalty of 5s. for non-lighting, as agreed upon by the Council at the last meeting. The Town Clerk was directed to write to write the Manager of the Gas Company to that effect. meeting of the Reading Town Council, the Gas Committee reported that

PUBLIC LIGHTING AND GAS TESTING AT READING.—At the last monthly at their meeting on the 25th ult., the Gas Inspector, Mr. R. F. Hart stated that he had tested the illuminating power of the gas seven times since his last report; it had varied from 13·03 to 14·12, the minimum standard being 12 sperm candles. Mr. R. Bradley, Secretary to the Reading Gas Company, wrote informing the Committee that the Directors of the Company had great pleasure, notwithstanding the contract now current with the Sanitary Authority for the supply of the public lamps, in being able to reduce the charge from the 31st March last from £2 10s. 6d. to £2 8s. 9d. per lamp per annum, being 2d. per 1000 feet on the estimated quantity consumed by each lamp. It will be remembered that, at the June meeting, the Council referred the questions of the testing the gas, and the general management of the lamps, back to the Committee. Mr. Hart now wrote that he had no wish to continue his services any longer than the Committee thought desirable, and that he trusted they would do what they considered to be for the best interests of the town in the matter, without any reference to him. The Committee, having considered the subject, resolved to recommend that it was desirable new arrangements should be made; that Mr. Hart should receive an intimation that the Council desired him to retire from the appointment of Gas Inspector, and that the Council do express to Mr. Hart their sense of the valuable and efficient services which have been rendered by him to the town during the 15 years in which he has held the appointment; that Dr. Shea be appointed, at a sum of £20 per annum, to test the illuminating power and purity of the gas, and that reports be made to the Committee monthly, as heretofore; that the Gas Company be requested to perfect the apparatus provided by them for testing the purity of the gas; and that all the duties hitherto discharged by the Gas Inspector, except such as will devolve upon Dr. Shea under the foregoing resolutions, be in future discharged by the Surveyor. The report was adopted.

WEST KENT MAIN DRAINAGE.—An official inspection of the works in connection with this extensive scheme was made on Thursday, the 4th inst., by Colonel Lennard and other members of the Drainage Board. The scheme was devised by Sir Joseph Bazalgette, C.E., who is the Consulting Engineer to the works, which are being carried out by Mr. Alfred Williams, C.E., of Westminster, as Engineer; Messrs. John Neave and Son being the Contractors. The works, which were started towards the end of 1876, consist of a main line of sewer, commencing in the parish of Lewisham, and passing through Bromley, Chislehurst, Bexley, and Crayford to the Thames at Long Reach. This line of sewers is about 11¼ miles in length,

while the Cray Valley branch is 6¼ miles long, making a total of 17¾ miles of sewers. The Cray Valley branch commences at Orpington, and serves all the towns in the valley of the Cray from Orpington to Crayford. It joins the main line of sewer at Bourne Bridge, Bexley, whence all the sewage will flow through one sewer, and will be discharged into a reservoir situated on the Dartford Marshes at Long Reach, and thence into the Thames upon the ebb tide at a point about seven miles below the outfalls of the Metropolitan sewers. The sewer is being constructed in Portland cement concrete instead of brickwork, by which means a considerable saving in cost is effected. The progress made with the work is satisfactory. From the starting-point at Lewisham to Penhill, in the parish of Bexley, a distance of nearly 5½ miles, the sewer is 6 feet high and 4 feet wide in tunnel, and of this 2¾ miles have been constructed. From Penhill to Long Reach, a distance of nearly 6 miles, the size of the sewer varies from 6 feet by 4 feet, egg-shaped section, to 5 feet 6 inches circular. Of this length about 5¼ miles have been completed, principally in cutting, although some embankment work occurs where the sewer crosses marsh land, which it does in several places. About three miles of the Cray Valley branch have been made, so that the total advance is 10¾ miles. Besides this, good progress has been made at the outlet works at Long Reach. There the Board purchased 16 acres of land, and upon this they are constructing a reservoir 500 feet long, subdivided so as to form filter-beds, with a capacity of 3½ million gallons. From this reservoir two lines of iron pipes, each 4 feet in diameter, convey the sewage across the foreshore to the bed of the river below low water. On each line of pipe there are two penstocks and a self-acting tidal valve, forming a double bar to the outlet of sewage, and a treble bar to the inlet of tidal water, when necessary. The reservoir and outlet works are in a forward state.

Register of New Patents.

995.—Caldwell, A., Strathbungo, "*Improvements in apparatus for measuring and controlling or regulating the flow or supply of water.*" Patent dated March 13, 1877.

This invention is in part a further development of an invention patented by the present inventor in 1876. It consists in connecting both ends of the cylinder with the water-main. In the branch which connects the two ends of the cylinder together are two valves, which are coupled by a rod or spindle, one end of the spindle, and by preference that whereat the smaller valve is situated, passing out through the otherwise closed end of the connecting pipe, is made water-tight thereat by a cup leather or equivalent packing. At times, when but a small quantity of water is being drawn off, the pressure on the small valve keeps it open, and the larger valve shut; but when a larger quantity of water is being drawn off than the small valve is capable of supplying, then, the pressure in the whole apparatus being reduced, a weighted lever acting upon the valve-spindle forces it downwards or inwards, at the same time opening the larger valve, and closing or nearly closing the small one. At such time the piston of the measuring cylinder is brought back very slowly by the small amount of water passing through the small valve.

997.—Brémond, L., Versailles, France, "*Improvements in means to be employed for preventing the deposit of naphthaline in gas apparatus, mains, and fittings.*" Patent dated March 18, 1877.

This invention has for its object, as the title imports, improvements in the process or means to be employed in the manufacture of gas, or to the gas subsequent to its ordinary manufacture and purification, whereby the deposit of naphthaline is prevented from taking place either in the gas apparatus on the gas-works, in the mains, services, or public light, or in consumers fittings.

The invention is based upon the assumption that dry gas, or gas from which the vapour of water has been wholly or in great part removed, will not deposit its naphthaline while in a dry or nearly dry state.

The invention consists, therefore, in drying the gas after it has left the washers or scrubbers, by passing it through a vessel or vessels of any convenient form containing a substance or liquid which absorbs moisture with avidity, such as chloride of calcium, quicklime, baryta, caustic potash, caustic soda, sulphuric acid, phosphoric acid, or other substances or liquids having an affinity for water. By this means the gas is dried, but as most of the vessels through which the gas has subsequently to pass are supplied with water, and as the gas would in passing through come in contact with and absorb water from these vessels, it is proposed that to the water with which they are charged a convenient quantity of oil, of nearly the same but rather lighter density than water, should be added, so that the gas, in its passage through these vessels, should be protected from coming into contact with water. In other words, that the cups of purifiers, station-meter tanks, gasholder-tanks, station governor-tanks, and in fact any other vessel ordinarily containing water, and through which the gas has to pass, should be supplied with oil as well as water, in order to prevent the water from vaporizing and becoming incorporated with the gas.

It is also proposed that, after the gas has passed through the station governor, and before it enters the mains, it (the gas) should again be passed through a vessel or vessels containing one of the desiccating materials before alluded to, in order to dry or deprive the gas of the vapour of water to the utmost.

Further, it is desirable that all syphons attached to the mains should be supplied with oil, to prevent the gas from absorbing moisture from the liquid frequently contained therein.

As an additional safeguard to prevent the deposition of naphthaline in the fittings of consumers, a box charged with quicklime, or other before-named material, may be connected to the outlet of the meter, and between it and the pipe leading to the fittings and burners. The material may be renewed from time to time, or whenever necessity dictates.

1001.—Crickmer, R. J., Homerton, London, "*Improvements in steam and other cocks or taps.*" Patent dated March 13, 1877.

This invention relates to an improved construction of steam and other cocks or taps, whereby they are prevented from sticking fast, owing to the expansion of the metal on becoming heated, and also from becoming leaky through wear. For this purpose the plug of the cock is made to fit loosely in the shell, and has two opposite recesses formed in it at those points of its cylindrical or coned surface which come opposite the passages or ways of the shell when it is turned into the closed position. Into these recesses are fitted loose pieces or shields, fitting accurately against the chamber of the shell, and pressed against the latter by two helical springs at the back of the shield, such springs being placed over steady pins fitting loosely into the back surface of the shields. By this arrangement, when the plug is turned so that the shields close the inlet and outlet apertures of the shell, and steam or other fluid or liquid pressure acts against one of them, it may, if sufficiently powerful to overcome the action of the spring, leak past the shield into the chamber of the shell; but the fluid pressure in the latter will tend to press the other loose shield against the outlet aperture, and thus cause it to close the latter effectually against any escape of liquid or fluid.

1049.—Weston, G., Sheffield, "*An improved apparatus for the lighting and extinguishing of public and other lamps.*" Patent dated March 16, 1877.

This invention relates to certain valves and other appliances for permitting, stopping, and controlling the supply of gas to public and other lamps, and for the lighting and extinguishing of such lamps, and is accomplished by the following ways or methods, that is to say:—The lighting of the main or principal light is accomplished by keeping constantly burning a small portion of gas in close proximity to the ordinary burner, so that when the gas issues from the ordinary burner it becomes ignited; and this small portion of gas is protected from being extinguished by causing it to burn within a perforated sleeve or pipe environment. The constant burning of this small portion of gas is accomplished by an independent or separate supply-pipe taken from the service-pipe immediately before it enters into any of the following apparatus. Three distinct methods or processes are proposed, by any one of which the permitting or stopping of the supply of gas to the main or principal burner is, or may be, accomplished, viz.—the automatic or differential pressure or flexible valve, the pneumatic or air-pressure action, and the electric.

1104.—Firmin, W., Hackney Road, "*Improvements in ball-valves or ball-cocks.*" Patent dated March 20, 1877.

These improvements chiefly relate to horizontal equilibrium ball valves or cocks, especially such as are used for supplying or discharging water or other liquid to or from pipes or cisterns; but they are also applicable to other ball valves or cocks. Horizontal equilibrium ball valves or cocks have hitherto been made with the body in two pieces, for the purpose of enabling the seating to be got into place, and these two pieces have been fastened together by flange-joints or screw-joints. By this invention it is proposed to make or cast the body in one piece, and to employ a plug, ball, or cone, composed of, or embedded in, india-rubber or other suitable flexible material, which plug is inserted through the end of the valve body, and acts as a valve to stop the supply of the water; also to employ a cup leather, or a small diaphragm. The plug before named is firmly fixed to a bush connected to a spindle, to which the ordinary lever is attached in the usual manner.

For equilibrium valves, the bush and plug are formed with a small longitudinal hole, to give passage to the water to the other side of the cup leather, or of the diaphragm before referred to; but in ball-valves which are not equilibrium valves, the bush and plug are solid.

1127.—Clark, A. M., Chancery Lane, London, "*An improved process for preventing the accumulation of carbon in retorts used for the distillation of carburetted hydrogen.*" A communication. Patent dated March 21, 1877.

The principle of the invention is explainable as follows:—In the distillation of gas from the bituminous variety of coal the products evolved during the first part of the process are the heavy hydrocarbon gases, together with a greater or less quantity of free carbon, thus ($C_4 H_4 + C$), the free carbon of which (C) is deposited by reason of the fact that an insufficient amount of hydrogen is at this time present to combine with and utilize the same in the formation of gas. The last products evolved in the process of distillation contain a sufficient proportion of light carburetted hydrogen gas ($C_2 H_4$), in which the hydrogen is in excess, to prevent the further deposition of carbon; but, inasmuch as the excess of free carbon first given off is deposited in crystalline form before the evolution of the excessive hydrogen of the light carburetted hydrogen ($C_2 H_4$) takes place, the excessive carbon of the first part of the distillation and the excessive hydrogen of the last part of the distillation are not associated simultaneously with their evolution; and the carbon not being in a nascent state they do not therefore chemically unite to form a hydrocarbon, but the gas produced is charged with an excessive quantity of hydrogen, which detracts from its illuminating properties, while at the same time the retort is clogged with a deposit of carbon, which prevents the best utilization of the coal, and also to a large extent obstructs the transmission of heat to the materials in the retort. To obviate this difficulty it is proposed to employ two kinds of coal, charged simultaneously. One of these coals (the bituminous) evolves by reason of its richness the heavy carburetted hydrogen ($C_4 H_4$), and gives at the same time the deposit of carbon (C). The other coal (the semi-bituminous) being less rich in carbon, evolves from the outset only light carburetted hydrogen ($C_2 H_4$), in which hydrogen is in excess. Now, by charging the retort with these two coals at once, there will be two coals evolving simultaneously, and from the commencement, the one carbon in excess, and the other hydrogen in excess, and inasmuch as the evolution of the free carbon and the excessive hydrogen—*i.e.*, the two extra equivalents of the light hydrocarbon—takes place together and simultaneously, their nascent condition and intimate gaseous association compels them to unite to form a hydrocarbon, thus—

$$\text{Bituminous coal} = C_4 H_4 + 4\,C;$$
$$\text{Semi-bituminous coal} = 2\,(C_2 H_4);$$
$$\left.\begin{matrix} C_4 H_4 + 4\,C \\ 2\,(C_2 H_4) \end{matrix}\right\} \text{Generated simultaneously} = 3\,(C_4 H_4);$$

which product is a permanent and stable illuminating gas but little liable to depreciation.

It is evident that the result attained is largely due to the relative position or local relation in the retort of the two kinds of coal used, since the light product eliminated from the semi-bituminous coal placed at the back end of the retort in passing forward to the stand-pipe mingles with the heavy hydrocarbon vapours generated from the bituminous coal, and also comes in contact with any carbon particles that may have been deposited on the surface of the retort.

1152.—Cotton, J., Bowling, "*An improvement in the construction of taps and cocks.*" Patent dated March 23, 1877.

In that construction of taps and cocks in which the valve-seat is parallel with the axis of the barrel the seat has been found to wear rapidly, and thereby to render the tap leaky and ultimately useless. To remedy this defect it is proposed, instead of casting the valve seat, with the partition which divides the barrel, in two parts (the inlet and the outlet), to fit the valve-seat to the partition in such way as will permit of its ready removal when worn, and its replacement by a new valve-seat.

The opening in the partition, through which the water or other liquid flows, has a screw thread cut in it to receive a ring of suitable sectional shape, which is to constitute the valve-seat. This ring is to be cast of a polygonal or other convenient form or figure internally, to receive a key of corresponding shape, which is used to insert the ring in its place, and to remove it therefrom when the lip or seat to the valve is worn. Access to the valve-seat, or for the partition which is to receive it, will be obtained by removing the box in which the valve-stem is fitted.

APPLICATIONS FOR LETTERS PATENT.

2683.—Foulis, W., Glasgow, "New or improved apparatus for governing the flow and pressure of water and other liquids." July 5, 1878.

2686.—Cowan, W., Edinburgh, "An apparatus for automatically varying the load and pressure in gas governors." July 5, 1878.

2695.—Mackay, G., Edinburgh, "Improvements in the purification of liquids, and in the utilization and preparation of certain waste and bye products of art and manufacture as purifying agents." July 5, 1878.
2700.—Tomlinson, W. F., and Fearnley, G. B., Leeds, Yorks, "An improved self-acting apparatus for regulating the supply of gas." July 5, 1878.
2704.—Smethurst, J., Clifton, Lancs, "Improvements in arrangements and apparatus for treating smoke, gases, vapours, and noxious gaseous discharges from fires, furnaces, chemical, sewage, manure, and other works or manufactories, and utilizing the products therefrom, parts of which improvements are also applicable to the manufacture of gas, and for cooling and purifying air for ventilating buildings and mines." July 6, 1878.
2707.—Boulton, M. P. W., Tew Park, Oxford, "Improvements in combined gas and steam motor engines." July 6, 1878.
2711.—West, E. W., Liverpool, Lancs, and Sturgeon, J. and T., Newlay, Leeds, "Improvements in direct-acting engines and pumps." July 6, 1878.
2733.—Wise, W. L., Adelphi, London, "Improvements in treating impure water or liquid to purify the same, which improvements are especially applicable to the treating of sewage to obtain certain products therefrom." A communication. July 8, 1878.
2755.—Amos, C. F., and Smith, H. W. R., Kingston-upon-Hull, Yorks, "Improvements in double-action pumps." July 9, 1878.
2762.—Wirth, F., Frankfort-on-the-Maine, Germany, "Improvements in condensers." A communication. July 10, 1878.
2780.—Melling, T., Aigburth, Lancs, "Improvements in and relating to apparatus for reducing or regulating fluid pressure, and for measuring and registering the pressures and quantities of water or other fluid flowing in given times through pipes or other conduits." July 11, 1878.
2787.—Hébert, L., and Kemp, C. R., Paris, "Improvements in the distillation and rectification of petroleum, and in apparatus for the employment of the liquids thus obtained for lighting and heating." July 11, 1878.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

4930.—Legendre, L., Kennington, London, "Improvements in pumps or apparatus for raising water and other liquids to any height by suction or by suction and compressed air, and without the liquids passing through the pumps." Dec. 29, 1877.
101.—Penney, J., Stockport, Chester, "Improvements in ferrule taps, and in the method of connecting the same to steam, gas, and water-pipes, and in apparatus employed in effecting the connection." Jan. 8, 1878.
103.—Sugg, W. T., Westminster, "Improved apparatus for purifying illuminating gas." Jan. 8, 1878.
161.—Jordan, C., Newport, Monmouth, "Improvements in joints for connecting pipes or tubes for gas, water, or other purposes." Jan. 12, 1878.
228.—Ramsbottom, J., Leeds, "Improvements in engines for obtaining motive power from liquid and gaseous fluids, and for pumping and compressing." Jan. 17, 1878.
244.—Livesey, J., Westminster, and Kidd, J., Wandsworth, London, "Improvements in the production of combustible gas, and in the enrichment thereof for illuminating purposes, and apparatus therefor." Jan. 18, 1878.
260.—Clark, A. M., Chancery Lane, London, "Improvements in wet gas-meters." A communication. Jan. 19, 1878.
363.—Clark, A. M., Chancery Lane, London, "Improvements in and connected with apparatus for filtering water." A communication. Jan. 28, 1878.
382.—Wigham, J. R., Dublin, "Improvements in apparatus for producing or enriching combustible gas for illuminating purposes, more particularly applicable for illuminating lighthouses." Jan. 30, 1878.
573.—Simon, H., Manchester, "Improvements in apparatus for raising or propelling water and other liquids." A communication. Feb. 12, 1878.
1000.—Garrood, G. W., Twickenham, Middlesex, "Improvements in cocks, taps, and valves, for water and other fluids." March 13, 1878.
1540.—Owen, S., Coventry, Warwick, "Improvements in and connected with modes and apparatus for opening and closing cocks and valves, especially applicable to the lighting and extinguishing of street and other lamps." April 17, 1878.

PATENTS WHICH HAVE BECOME VOID.

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

2131.—Maxwell, N. M., "Improvements in the construction of taps or cocks." June 10, 1875.
2183.—Johnson, J. H., "Improvements in wrenches or spanners." June 14, 1875.
2207.—Holt, H. P., "Improvements in steam-engines, more particularly with reference to valves for regulating the escape of waste water, injection, and vacuum." June 16, 1875.

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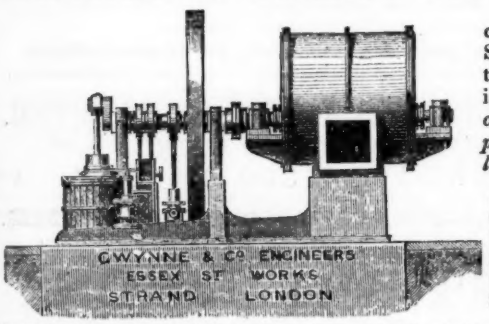

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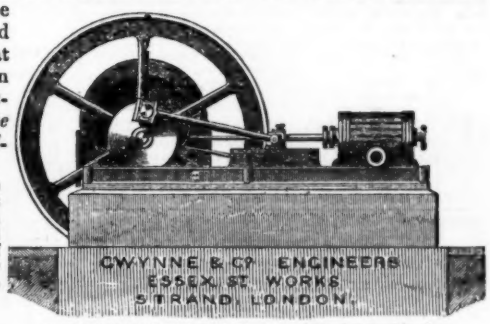

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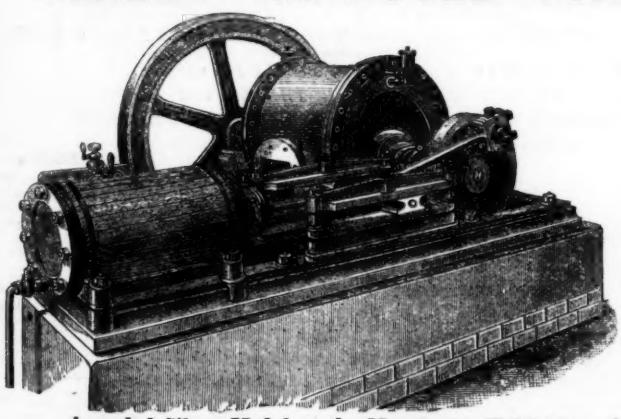

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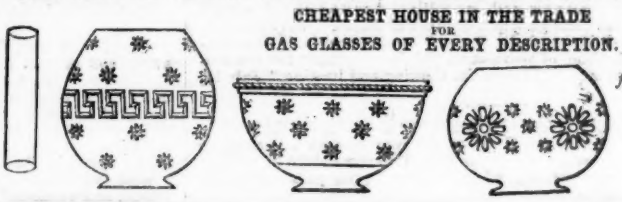

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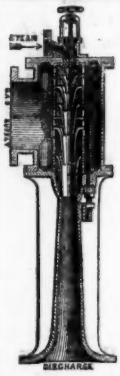

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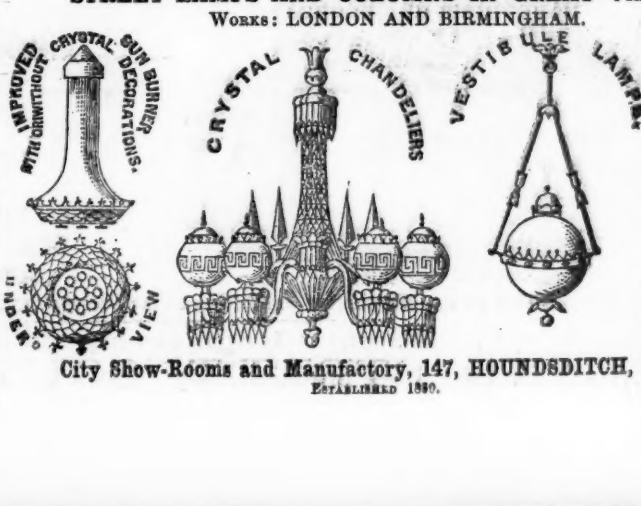

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35A, GREAT GEORGE STREET,
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PATENTEE and MANUFACTURER of the following Invention
RETORT SETTINGS—giving great Economy of Fuel.
STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.
FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.
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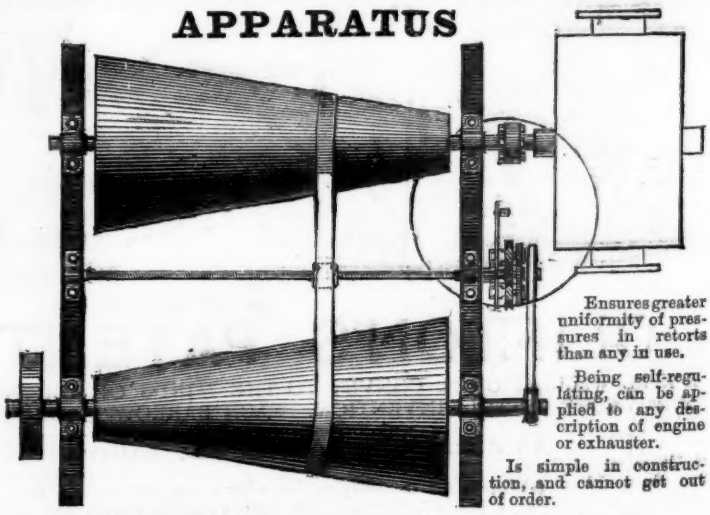

Ensures greater uniformity of pressures in retorts than any in use.
Being self-regulating, can be applied to any description of engine or exhauster.
Is simple in construction, and cannot get out of order.

JASPER & WM. SNOWDON, Manufacturers,
OLD BANK CHAMBERS, PARK ROW, LEEDS.
Full Particulars, Testimonials, Descriptive Circulars, Estimates, &c., on application.

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PATENT ANTIMONY PAINT.

MADE ONLY BY

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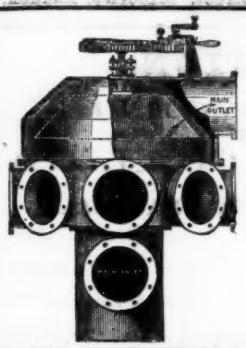
This Paint having been in general use over sixteen years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known. Its advantages are that—

It does not require DRIERS like other Paints.

It does not poison the painter like white lead. No colic by its use.

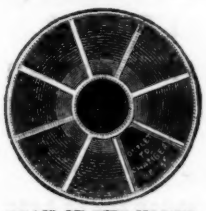
It has greater durability in colour, as sulphurous gases do not blacken it as they do white lead.

It is of a light stone colour, and has a body equal to white lead, and as its specific gravity is so much less, it covers equally well one-third more surface, by which a great saving is effected; a similar economy arises from its use in steam and gas joints, for which purpose it is superior to white lead.

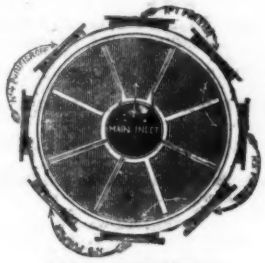


ELEVATION OF THE CENTRE-VALVE.

C. & W. WALKERS'
PATENT CENTRE-VALVES.



PLAN OF THE VALVE.



PLAN OF THE BODY.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

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IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.

And all kinds of Experimental Gas Apparatus.

THE

STANDARD WASHER AND SCRUBBER.

[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]

Some of the advantages claimed for this Apparatus are as follow:—

The Exposing of a large Amount of Effectually-wetted Surface (which is continually reproduced) to act upon the Gas.

Unerring Regularity in the Distribution of the Liquor.

Saving of Expense in Providing and Exchanging Scrubbing Material—none being required.

Economy of Space, thus enabling the Apparatus to be protected from the Weather.

Economy of First Cost and of Maintenance.

It works without Pressure.

It is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured.

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GAS COAL COLLIERIES, NEAR WREXHAM,

Are prepared to Supply their excellent GAS COAL on very favourable terms.

This Coal yields more than 10,000 cubic feet per Ton of gas of good quality, *in practical working on the large scale.*

A large purchaser reports the coke to be clear, of a quality rarely equalled in the retort-furnace, and much liked by the stokers.

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PORTABLE PIPE SCREWING MACHINE,

For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

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PATENT SCREW & CAM GAS-VALVES.

SIZES from 2 In. to 48 In.

As supplied to THE GASLIGHT & COKE CO., LONDON:

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And to the various WORKS of the BRITISH GASLIGHT COMPY.

Every Valve warranted perfectly Gas-tight.

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GREAT SAVING OF LABOUR.

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PORTABLE DRILLING-MACHINE,

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Drills, 1s. 6d. each.

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CONTRACTORS FOR THE

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BY THEIR

PATENT HYDRATED PEROXIDE OF IRON MATERIAL.

The Material is adapted specially for taking up sulphuretted hydrogen, and will simultaneously absorb any ammonia that may pass the scrubbers.

The spent oxide resulting from our Material is more valuable than that from natural oxide of iron, and manufacturing chemists buy it in preference.

The Material has now been in use during the past three years in most of the principal Gas-Works in Yorkshire and elsewhere.

It contains considerably less moisture than natural oxide of iron, and is much cheaper and more efficient as a purifying agent.

B. & H. are purchasers of Spent Oxide, or will take Spent in exchange for New Material.

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GLOBE METER-WORKS,

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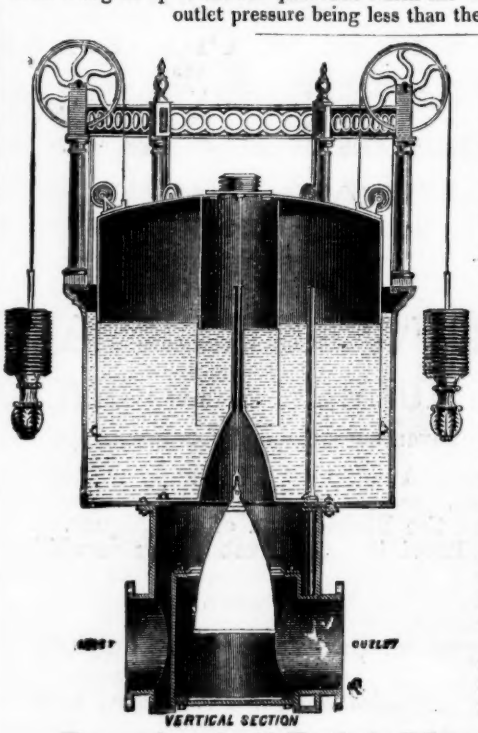
Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

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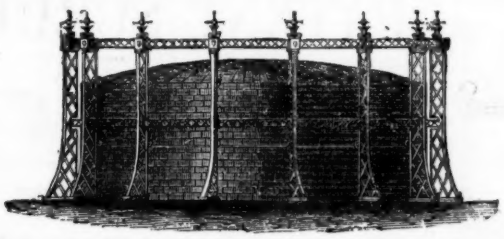

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ALSO

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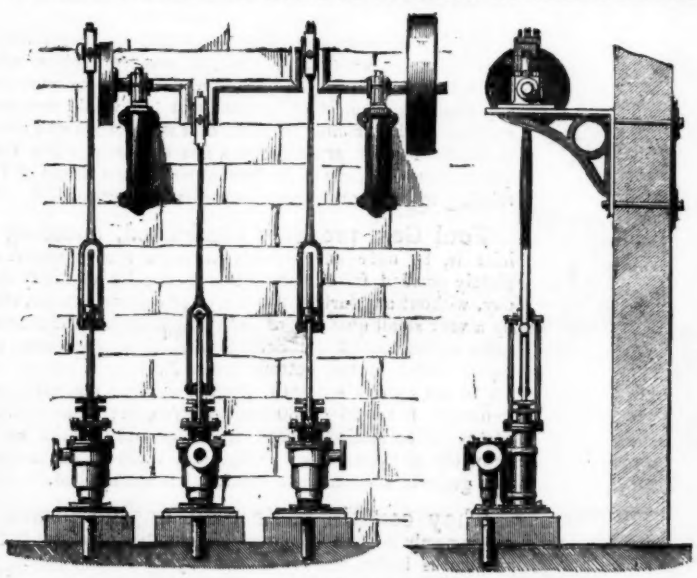
BLAKE'S PATENT DIRECT-ACTING STEAM-PUMPS.



IMPROVED DOUBLE-ACTION PUMPS.

For Water. For Tar. For Ammoniacal Liquor.

This illustration shows an arrangement of three (No. 179) Improved Double-Action Pumps driven from the same crank-shaft, as frequently supplied for use in Gas and Chemical Works. The suction and discharge pipes can be arranged for drawing from and delivering in any required direction.

These Pumps have been supplied to nearly all the large Gas Companies and Chemical Works, both for Pumping Water, Tar, and Ammoniacal Liquor.

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Keep in London and at their works large stocks of PIPES and CONNEXIONS (1¼ to 36 inches in diameter); also make and supply Retorts, Tanks, Columns, Girders, Special Castings required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

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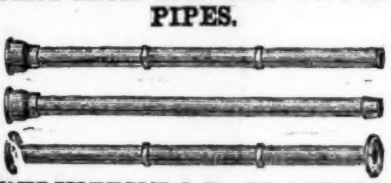

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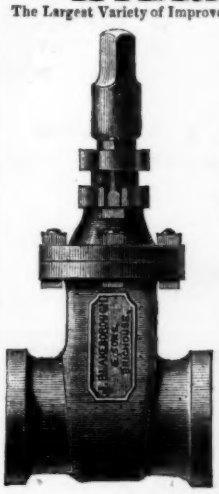

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REFLUX VALVES.
BALL VALVES.
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Tested with 600 to 900 feet head of pressure.

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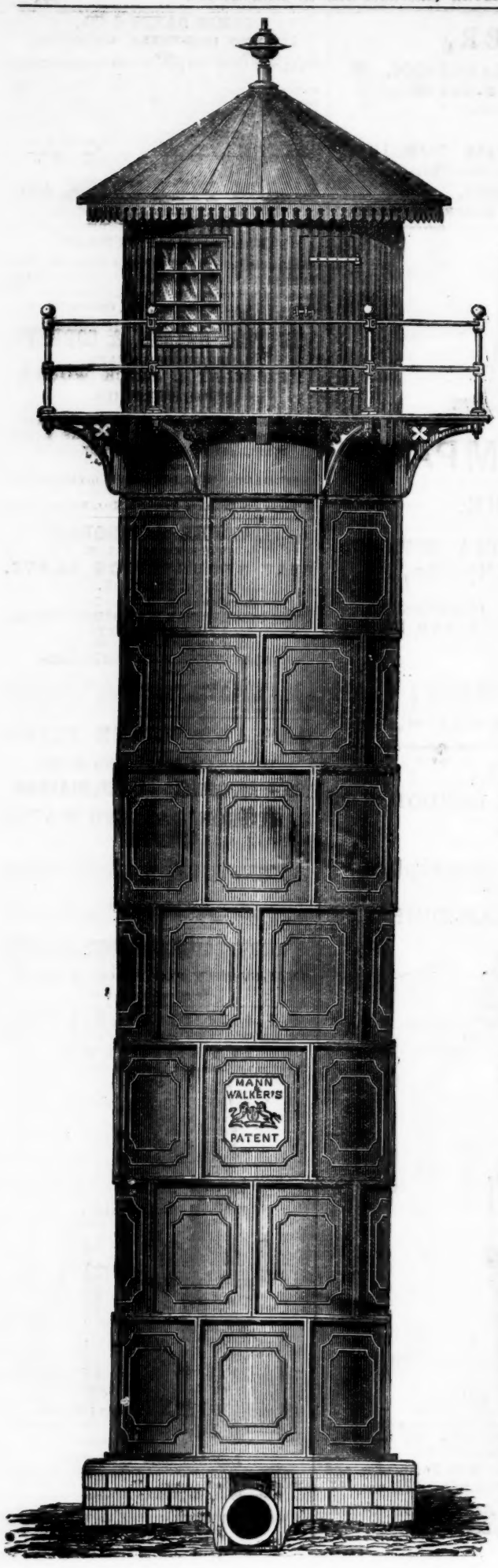

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MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the im- portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, re- quiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

WILLIAM SUGG,

GAS ENGINEER,

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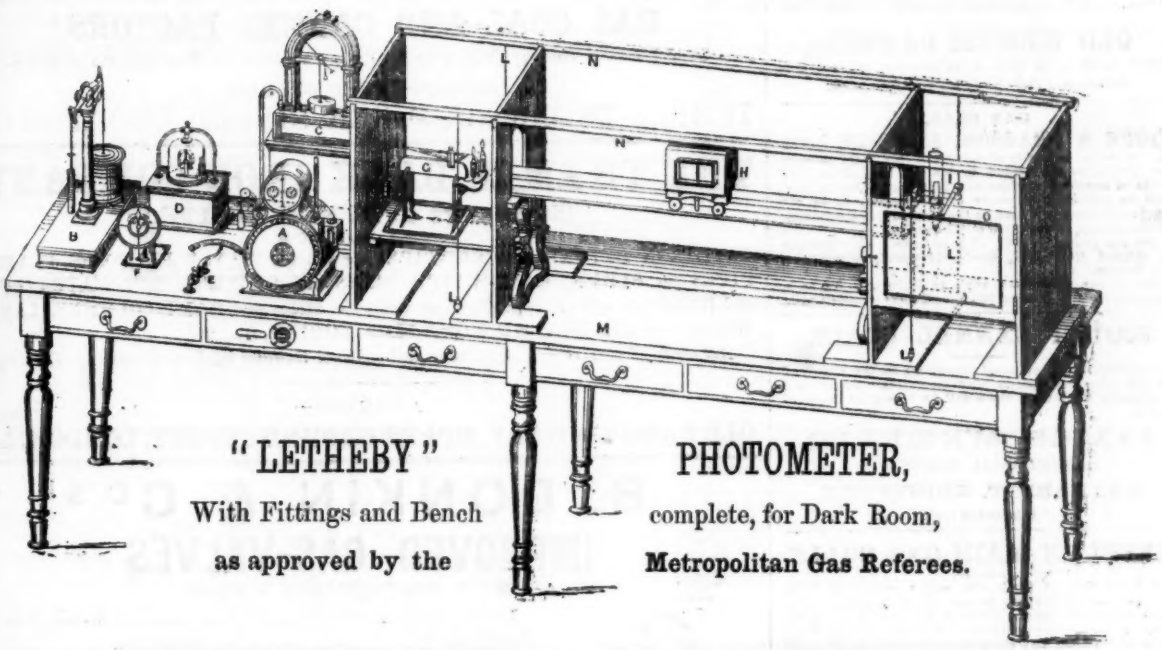


"LETHEBY" PHOTOMETER,

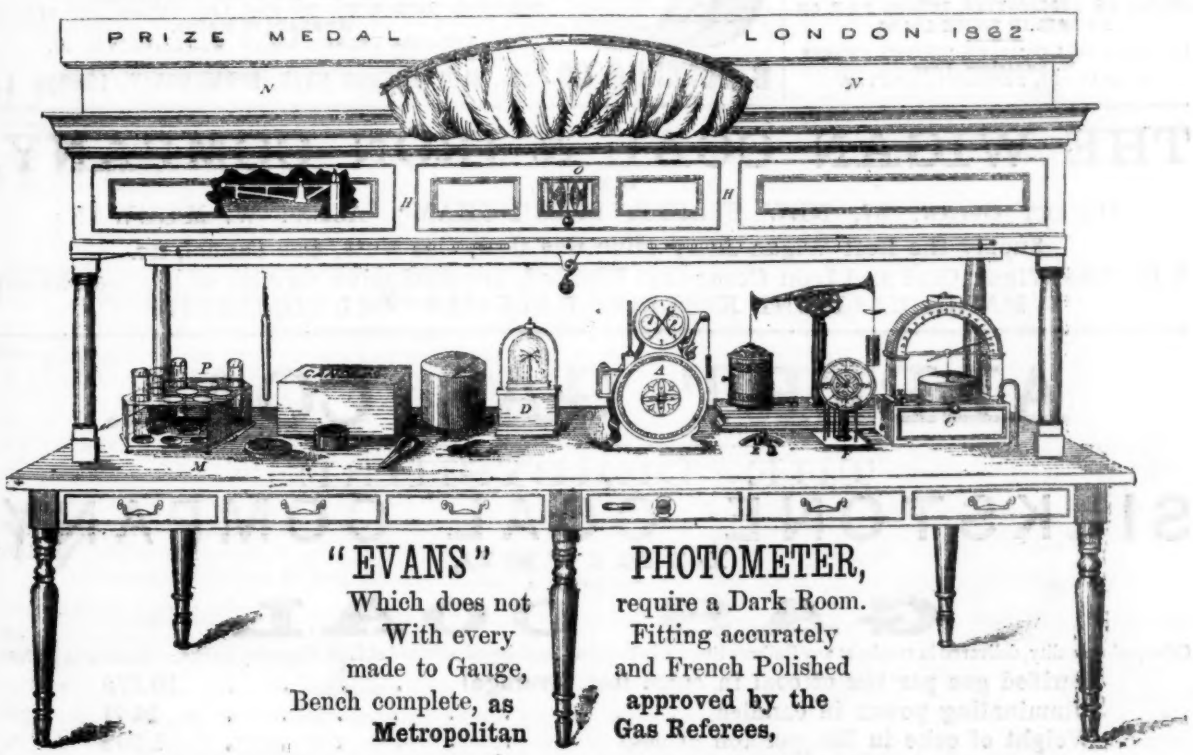
With Fittings and Bench complete, for Dark Room,

as approved by the Metropolitan Gas Referees.

IMPROVED LOWE'S JET PHOTOMETER.

WILLIAM SUGG'S PATENT ILLUMINATING POWER METER.

All Kinds of Gas-Testing Apparatus of the most approved forms.



"EVANS" PHOTOMETER,

Which does not require a Dark Room.

With every Fitting accurately made to Gauge, and French Polished Bench complete, as approved by the Metropolitan Gas Referees,

And as supplied and fixed by me at the Metropolitan Testing-Stations.

Price Lists and all Particulars on application.

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LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 13,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full Analyses on application.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

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Established 1840.

HEBBURN MAIN GAS COALS.

T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,594 cubic feet per ton of 14¼-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

PRICES ON APPLICATION, EITHER F.O.B. OR BY RAIL IN TRUCK LOADS.

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AGENT FOR

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Analyses and Quotations on application.

WILSON CARTER AND PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.

Address—CHIEF OFFICES:

TEMPLE BUILDINGS, 50, NEW STREET, BIRMINGHAM.

THE THAMES BANK IRON COMPANY,

(Successors to LYNCH WHITE,)

SUPPLY FROM STOCK

CAST-IRON RETORTS, SOCKET-PIPES for GAS or WATER PURPOSES, FLANGE-PIPES for STEAM, RAIN-WATER PIPES and GUTTERS, HOT-WATER PIPES and BOILERS, and all requisite Connexions for same; also LAMP-COLUMNS, LAMPS, WROUGHT FRAMES, WROUGHT-IRON TUBING, &c., &c.

All kinds of Gas-Works Apparatus and General Castings made to Pattern or Drawing.

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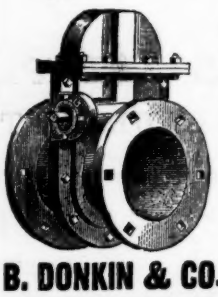
IMPROVED GAS-VALVES

WITH WROUGHT-IRON PINIONS.



List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.

These Valves are proved on both sides to 30 lbs. on the square inch before leaving the works, and are kept in stock.

In ordering Valves, please state whether required for under or above ground, and if to be with flanges or spigots and sockets cast on, or with separate spigot and socket pieces.

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STEAM-ENGINES FOR DRIVING GAS EXHAUSTERS,
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DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN;

Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

ALBERT GAS COAL.

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SILKSTONE COAL COMPANY,

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GAS COAL

Of superior quality, delivered in trucks at any Railway Station in England, or shipped on board at Hull, Grimsby Docks, or Barrow-in-Furness.

Purified gas per ton of coal in cubic feet (average)	10,775
Illuminating power in candles	14·71
Weight of coke in lbs. per ton of coal	1,502

ANALYSIS AND PRICES ON APPLICATION TO

Mr. EDMUND TAYLOR, Secretary,

ALBERT COLLIERY, NEWBOLD, NEAR CHESTERFIELD.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

HYDRATED PURIFYING MATERIAL.

Samples on application.

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Will be glad to supply the above on the most favourable terms,

And to treat, by Purchase or Exchange, for Spent Oxide.

PRICES ON APPLICATION.

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VICTORIA CHEMICAL WORKS, BRADFORD, NEAR MANCHESTER.

Established

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THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

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SPECIAL NOTICE.—Our Patent Machine-made Retorts have now been in *actual work* nearly 1000 days, and are yet in good order. References on application.
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NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

"*Warrington Gaslight and Coke Company,*
Offices, Mersey Street, Warrington, April 23, 1877.

"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of **12,500** cubic feet of **15½**-Candle Gas, being equivalent to **664** lbs. of sperm per ton, and **1420** lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

"Yours truly, "JAMES PATERSON."

Full particulars will be sent on application to us—address as above.

NEW PATENT WET GAS-METER,

THE "RELIANCE,"

MANUFACTURED BY THE

GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

The object attained by this invention is the *correct measurement of Gas under every fluctuation of the pressure.*

Accuracy is obtained by subjecting the whole of the water which determines the measuring chambers of the drum to one uniform even pressure, and so prevents unequal displacements of the water-line.

The "RELIANCE" METER has been tested by several of the most experienced official meter inspectors. Copies of their reports may be obtained on application to the

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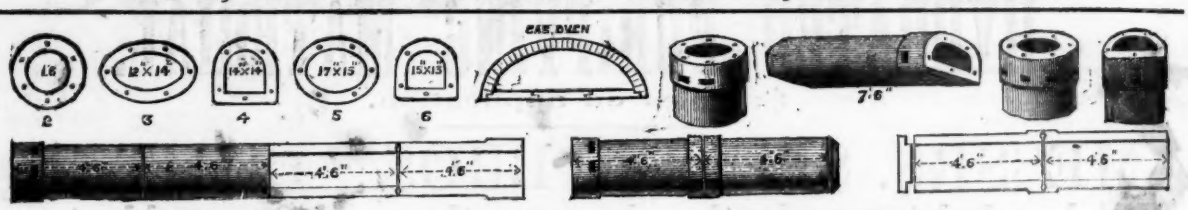

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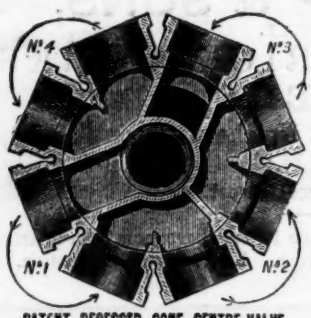


PATENT RECESSED CONE CENTRE-VALVE.
Sectional Plan.

R. LAIDLAW AND SON,

EDINBURGH AND GLASGOW,

SOLE MAKERS OF

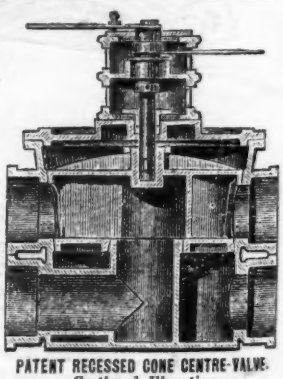
PATENT

RECESSED CONE CENTRE-VALVES,

Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

Of all descriptions.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Elevation.

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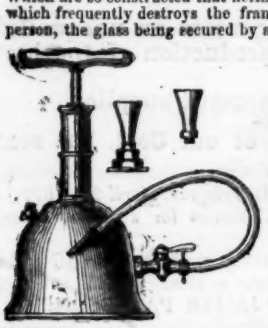
Invite the attention of Gas Companies, Corporations, and others to their

PATENT STREET LAMPS,

Which are so constructed that neither putty nor other materials are required to secure the glass. No hacking out of old putty, which frequently destroys the frames. A new pane of glass can be inserted in two or three minutes by any inexperienced person, the glass being secured by a hinged flap and turn button.



PRICE 10s. each, net. Special quotations for large quantities.
Also made EXTRA STOUT recommended for its durability, PRICE 11s. 6d. each.

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By the use of which stoppages in service and other pipes are freed from naphthaline and other obstructions in a few minutes. PRICE 73s. net.

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For inserting in mains, to prevent the excess of pressure in high ground, or other elevated positions.

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London: Printed by WILLIAM BOUGHTON KING (at the office of Clayton and Co. 17, Bouverie Street, Fleet Street); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, July 16, 1878.